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The Toxic Substances Dilemma
A Plan for Citizen Action

National Wildlife Federation
Washington, DC

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A Plan for Citizen Action

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This manual provides a clear explanation of the concept of a toxic substance, the biological and ecological effects of such substances, and the risks associated with their use. The federal laws which govern the manufacture, distribution, use, discharge & disposal of toxic and hazardous materials are identified and explained. Detailed guidance for citizen actions is also provided, along with an actual case study which develops a general method for pinpointing and studying sources most likely to pose health and environmental risks because of toxic discharges into waterways.

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Introduction

Is nothing in the world safe any more?

Every day, it seems, another harmful chemical is found in the water we drink, the food we eat, the very air we breathe. Fish are dying, our streams, lakes, and beaches are polluted, smog fills the air, litter lines our roads, our workers are getting cancer from the materials they manufacture, our land and water are being used as a dumping ground for all kinds of harmful waste products.

Are the hazards exaggerated? Are the newspapers and environmentalists crying "Wolf!" when there is no wolf? Or are we in fact in real danger? The answers to these questions may affect the quality of your life, your health, and how long you live.

It is the purpose of this handbook to examine one part of the pollution picture—the complex subject of "toxic substances,"—reviewing technical, legal, and economic facts and issues so that social conclusions can be drawn intelligently. Knowledge is strength.

Realizing that there is a serious problem affecting you and your environment, and becoming familiar with the facts and issues affecting this problem and its solution, is at least half the battle.

But to win the battle, positive action must be taken. Don't just rely on the other guy; *you* can play an active part in *doing something constructive* to improve the quality of your life.

This manual will supply information you need to help you decide what should be done and how you can help get it done. In addition to furnishing authoritative facts about toxic substances, the manual will alert you to misconceptions and myths detrimental to your best interests and to those of generations yet unborn.

With this background, you will be able to better understand and evaluate the seriousness of environmental horror stories and to prevent their repetition.

The handbook will describe what *you* can accomplish. We will get down to details. We will study a specific area, the State of New Jersey, using it as an example of how a problem can be attacked in any locality. We will go through a procedure, step-by-step, which you can modify and adapt to study and identify problems in your own community.

Everyone will agree that mass poisoning of human beings, wildlife, the entire environment, must be brought under control. But the mechanisms and costs of doing so receive less agreement. We hope that this handbook will guide you in continuing and strengthening the start society has made in tackling the problem.

The manual is organized to:

a) provide a clear explanation of toxics, their effects and comparative risks;

b) explain the Federal laws which control toxics;

c) demonstrate through a real case study how action in New Jersey was accomplished;

d) provide detailed guidance for you, the citizen, to be effective in your own area.

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THE TOXIC SUBSTANCES DILEMMA

A Plan for Citizen Action

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Chapter I Summary

Death in the Real World

In Hopewell, Va., Kepone—an insecticide—was being manufactured by Life Sciences Products (LSP), under contract to Allied Chemical Company. Sickness—in the form of tremors, eye twitching, liver damage, and reproductive problems—developed in LSP's employees, their families and friends. People living within 1 mile of the plant and those who consistently ate fish from the James River (which flows past LSP's plant) were also affected.

Investigation disclosed grossly inadequate safeguards to contain Kepone dust during production and packaging, with the result that employees were touching and breathing the product, and their bodies and clothing were covered with powder, which was thus carried home. Further, wastes were being dumped illegally into the James River, the largest river in Virginia. Kepone traces showed up in fish from the Chesapeake Bay to Martha's Vineyard in New England.

Subsequently, in 1975, the plant was shut down, the lower James River was closed to commercial fishing, and a Federal grand jury indicted Allied, LSP, LSP's owners, and the city of Hopewell.

Allied and LSP had disregarded tests of Kepone which indicated danger, including cancer. Allied was fined over $13 million. A relatively modest investment could have made the LSP plant safe.

Love Canal is a neighborhood near Niagara Falls, N.Y. From the 1920's to the early 50's, an empty canal site was used as a chemical waste dump by Hooker Chemical and Plastics Corporation. In 1953, Hooker sold the land to Niagara Falls Board of Education which covered it over and built a school. Developers built homes. By the 1970's trouble was evident. The drums containing the chemicals rotted, and toxic chemicals seeped into the soil and water. The result has been birth defects, miscarriages, and organic diseases. The state of New York closed the school and evacuated 239 families.

These are not isolated instances. There are an awesome number and quantity of chemicals used in the U.S., and an increasing realization of the role of toxic substances in the environment on the incidence of cancer and respiratory ailments. Toxic substances are being inadequately controlled and regulated, partly because of our inability to assess risk accurately. Also, human risk from toxic chemicals is non-voluntary and is not always apparent. Recent legislation is a necessary and major advance, but is no guarantee of results.

CHAPTER I

Death in the Real World

On-the-job hazards continue to kill, maim, and make ill our nation's workforce at an unacceptable rate . . . Business is too willing to spend its time and resources fighting job safety and health.

—Dr. Eula Bingham, Head
U.S. Occupational Safety and
Health Administration

We read about real and present dangers from toxic chemicals in our newspapers on a regular basis. Human lives have been crippled and lost; recreational areas have been destroyed; dead fish float on our rivers or, still swimming, are so loaded with poisons that they cannot be eaten.

This section of the manual describes two disasters that have already taken place. These are only the tip of the iceberg. Below the water's surface—literally—lies the potential for increasingly severe environmental degradation and human destruction.

Kepone: Environmental Disaster

In July, 1975, in Hopewell, Virginia, a chemical plant employee made history by going, not to his company doctor, but to his private physician, Dr. Chou. The man complained of tremors, weight loss, and nervousness. He could hardly stand or hold a cup of coffee. His eyes moved uncontrollably.

Fellow employees with similar symptoms had been told by company and local doctors that they had "nerves."

Dr. Chou, to his everlasting credit, sent a sample of his patient's blood to the government's Center for Disease Control—which started an investigation leading to the unraveling of an environmental ball of horror. The employee's blood contained a dangerous level (7.4 ppm) of Kepone!

The employee worked for an obscure little plant—Life Sciences Products (LSP)—which manufactured Kepone, an innocent-looking gray insecticide powder. Later that month LSP closed its plant "voluntarily," two days before an executive closing order was issued by the Virginia State Department of Health.

At this writing, in 1979, the effects of the catastrophe are not ended, but the outlines of the disaster are clear.

Kepone affects not only insects, but animals, birds, fish, and people as well. It started in 1950, when a patent for the production and use of Kepone—a chemical relative of DDT—was filed by two employees of the giant-sized Allied Chemical Company. From 1963 to 1965, Hooker Chemical Company produced Kepone for Allied. By 1965, Allied was manufacturing and selling Kepone on a sporadic, low-volume basis.

Demand increased. In 1973, Allied contracted with a small company, LSP, to produce Kepone to meet Allied's increasing requirements. Production in a converted gas station in Hopewell, Virginia, began early in 1974. LSP's production almost doubled the Kepone output. Less than two years later, the facts started surfacing; the investigation initiated by the blood sample taken by Dr. Chou disclosed a Pandora's box of toxic effects.

First, there were the people, some of them very sick indeed. About 30 people had been in and out of the hospital—some two, or three, or five times. More than 200 men, women, and children were found who had detectable levels of Kepone in their blood. Over 50 were stricken by "Kepone sickness," exhibiting an assemblage of symptoms never before seen: severe nervous effects (tremors—or the "Kepone shakes"); uncontrollable twitching of the eyes; liver damage; reproductive effects, including possible future sterility. The possible future effects on the health and very life of these people are presently unknown. However, physicians at the Medical College of Virginia have found a drug, cholestyramine, which speeds up the natural excretion rate of Kepone, and which has been successfully used to greatly reduce Kepone blood levels in LSP workers.

Kepone has been demonstrated to cause cancer in test animals (although the validity and significance of these results has been questioned). As we will discuss in a later section, chemicals which cause cancer in animals almost certainly will cause cancer in human beings. Such cancers typically show up some 20 to 30 years after exposure.

Primarily, those affected worked in the LSP or Allied plant, were workers' families and friends, or were people living within about one mile of the plant. There was one other sizeable group of victims whose blood contained Kepone—some 20 steady consumers of fish taken from the James River, which flows past LSP's plant. Which brings us to the issue: who was exposed to Kepone and how?

Just because Kepone, or any other chemical, is potentially toxic to human beings does not *necessarily* mean that its manufacture and use will cause injury to workers or anybody else. Injury from a chemical requires both toxicity and *exposure*. To injure a person, a toxic chemical must enter that person's body . . . by contact, inhalation, or ingestion. In other words, it can't hurt you unless you touch it, breathe it, eat or drink it.

Inspection of the Kepone plant demonstrated that even the most rudimentary safeguards to prevent exposure to Kepone were not used. Everything at the plant site was covered with Kepone dust. Dr. Jackson, the state epidemiologist, reported: "There were three to four inches of the material on the ground . . . There was a one- to two-inch layer of dust encrusting everything." Little effort was made to contain Kepone dust during production and packaging. The air was thick with it. It was in the air the workers breathed; respirators were seldom if ever used. Winds carried the dust to the surrounding community. Everything the workers touched had a layer of Kepone. Bodies and clothing were covered with the powder, and thus carried home by workers. Fortunately, Kepone is dense, so is not carried far by wind.

But there was another route by which Kepone was carried far beyond the confines of the plant, extending the disaster area and the kinds of damage. Kepone entered not only the atmosphere, but the water and the soil. Rainwater washed Kepone into streams and ponds and then into the James River, the largest river in Virginia.

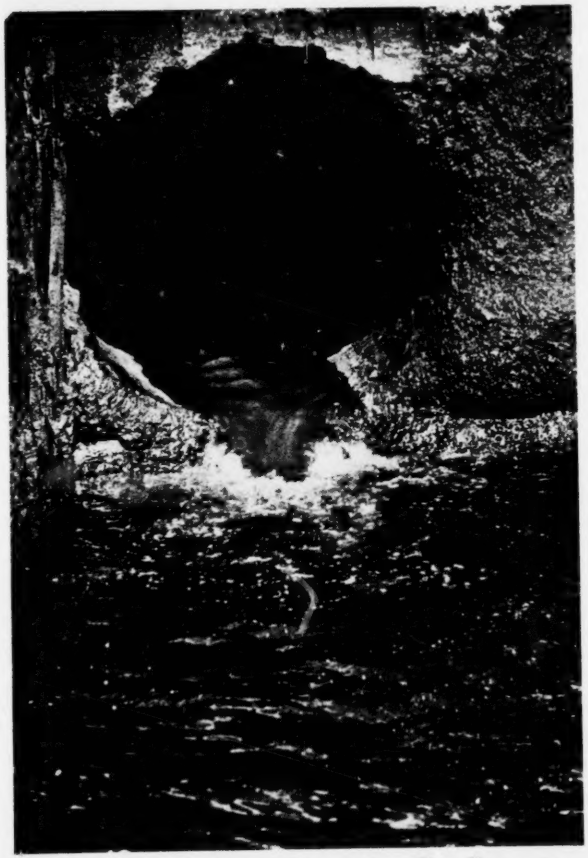
Even worse, Kepone spread because Allied Chemical Company's Kepone production wastes were disposed of by running them through a drainage pipe to Gravelly Run, a stream feeding into the James River. This fact was never reported to the Federal government as the law required. Former Allied employees reported that shovelsful of Kepone waste were regularly thrown into this illegal pipe.

When LSP began production, some of its wastes were put into Hopewell's sewer system, to be handled by the city's sewage treatment plant. An unknown amount passed through the plant into Bailey's Creek, a tributary of the James River. When the digesters at the Hopewell waste treatment plant became inoperative, and since the sludges contained some Kepone, the digesters were pumped into an artificial lagoon at the sewage treatment plant site.

In June, 1979, Allied reached an agreement with the State to build a more secure storage facility and transfer the sludge to it. By the end of 1979, all of the contaminated sludge had been sealed in EPA-approved disposal sites.

For years, Kepone had been finding its way into the waters around Hopewell. Once investigators started looking, they found Kepone in fish and wildlife far beyond Hopewell. Kepone is in fish, crustaceans, and shellfish; in plankton and other aquatic plants; in sediment in the water; in birds of prey and waterfowl.

In a later section, we will talk of bioaccumulation, the storing of poisons in the tissues of living organisms eating traces of these poisons. Kepone is bioaccumulated. Fish in waters containing Kepone store it up; birds, animals, human beings eating these fish can thus be exposed to substantial quantities of Kepone.



Kepone wastes were illegally dumped into the James River. Kepone-contaminated fish are found from the Chesapeake Bay to the coast of New England. Credit: John Littlewood, Christian Science Monitor

Contamination was so severe that the entire lower James River had to be closed to commercial fishing. A fishing industry involving the livelihood of 3,800 people was severely affected. A partial ban is still in effect.

Kepone-containing fish are not confined to the James River. Also contaminated are certain migratory fish in the Chesapeake Bay, in the estuary into which the York and Rappahannock empty, at the mouth of the Potomac, even fish—such as some bluefish and striped bas—as far away as Long Island Sound and Martha's Vineyard in New England. Fish in the markets of New York and Philadelphia were found to contain Kepone. It was consistently found in crabs taken near the mouth of the James.

There was no extensive checking for Kepone in mammalian wildlife along the James. What checking was done revealed the potential for widespread contamination. Kepone was found in waterfowl and birds of prey, especially those that eat fish, such as herons, osprey, and eagles. It was noted that there were only two osprey nests along the James in 1973, while the York had 28 and the Rappahannock 118. However, there is no evidence to link the number of osprey nests along the James with the Kepone contamination.

The record is clear.

1. Damage from Kepone was severe, whether measured in human sickness and suffering, dollars, or loss of environmental integrity.

2. The human and environmental horror was preventable.

There is a history of Kepone research which consistently signaled potential trouble.

In 1949, in a test performed for Allied, 10 mice were given a single dose of Kepone and were all dead in 48 hours. The dose was 50 mg/kg (about 1/10,000th of an ounce). Delayed toxicity and deaths were also observed for rabbits on whose skin Kepone was applied. In other tests done at the same time, severe tremors developed in all rats fed Kepone; half died before the completion of the 20-day feeding period. (The tremors were similar to those observed from DDT, chemically related to Kepone. Like DDT, Kepone is stored in body fat, and also in the liver, brain, and kidneys.)

Between 1958 and 1961, Dr. P.S. Larsen of the Medical College of Virginia, studied the effect of feeding low levels of Kepone—from 0 to 80 ppm—to rats for substantially their entire lifetimes of about 2 years. (Similar "chronic toxicity studies" are routinely used by the U.S. Food and Drug Administration in deciding on the safety of chemicals falling within its jurisdiction.) All rats fed 50 ppm and 80 ppm Kepone were dead within 25 weeks. All feeding levels produced increased mortality. Depressed growth and anemia were common; some rats died of hemorrhages. Severe liver, kidney, and testicle damage resulted.

From a study of tissues of rats fed Kepone, Dr. Larsen suggested that Kepone appeared to be causing liver cancer. Three outside consultants agreed. The FDA concluded that while liver damage was extensive, it was "equivocal" whether cancer resulted. These same tissues, preserved on slides, were studied in 1976 by the National Institute of Occupational Safety and Health (NIOSH), the research adviser to the Occupational Safety and Health Administration (OSHA). The Director testified before Congress that: "The conclusion drawn from these studies is that Kepone is definitely a carcinogen in animals."

Buttressing this conclusion is a mouse and rat study, initiated in 1974 and released in April, 1976, by the National Cancer Institute ("NCI"). This study demonstrated that

Kepone caused liver cancer in both sexes of mice and rats. However, some controversy has arisen concerning the experimental methodology and tumor identification, and further studies are being planned by NCI and the National Institute of Environmental Health Sciences.

In 1958 and again in 1965, FDA cautioned Allied against the hazards of inhaling Kepone. Yet in the LSP plant, concentrations of Kepone in the air were found to be such that an employee inhaled 30 mg a day, 3,000 times the NIOSH limit of 10 μg a day. A study made in 1965 showed that Kepone interfered with the reproductive process, was passed on in mother's milk, and was found in the offspring's organs.

Allied and LSP disregarded these repeated findings on the toxic nature of Kepone. Little, if anything, was done to prevent Kepone's entering the air, land, and water, and Allied concealed from the government the fact that it was discharging its production wastes containing Kepone into the James River, a violation of the law.

Responsibility for this tragedy can be largely, but not exclusively, ascribed to Allied Chemical Company and its offspring, Life Sciences Products. Let us not overlook the role of federal, state, and local government agencies which were slow to act; doctors and scientists who failed to recognize symptoms of workers; members of the Hopewell community who placed a higher value on the payroll and taxes from its industries than on the hazards to its citizens and those among the plant employees who knowingly (more or less) put their paychecks before the health of themselves and their fellow workers. As Vermont's Senator Patrick Leahy said:

> *". . . the testimony shows a pattern ranging from ineptitude to callous indifference to criminal conduct . . . [from] state authorities, the local authorities, the federal authorities, the parent company and the manufacturing company . . ."*

A Federal grand jury indicted Allied, LSP, LSP's two owners and the city of Hopewell on a total of 1,097 counts; 940 of those were against Allied for violating the Federal Water Pollution Control Act, 154 were against all parties except the City of Hopewell, and three were against the City of Hopewell. After some maneuvering, Allied pleaded "no contest" to the 940 counts and the other counts were dropped. Allied was fined $13.24 million and agreed to pay $5.25 million to the State of Virginia, of which $650,000 went to the City of Hopewell.

Allied Chemical reduced its financial penalty by "investing" $8 million in an environmental fund to help Virginia improve the quality of its environment. The Federal judge reduced the fine against Allied by an equivalent amount. Since a fine is not a tax-deductible expense, but a business investment (which this was called) is deductible, this maneuver could well have saved Allied several million dollars.

As a closing note, a U.S. study made in 1978 warned that attempts to remove Kepone-contaminated sediments from the James River could cost in the billions of dollars and "may not be technically feasible or financially possible . . . At the current rate, it will take decades for the James River to cleanse itself . . ." Complaints are made of the cost of regulation. yet, a relatively modest investment at the LSP plant could have made it safe. **The failure to make that investment resulted in the economic disaster just described, totaling many millions—perhaps billions—of dollars. Regulation which prevents disaster is an economic saving, not a burden.**

Evacuation followed the occurrences of miscarriages, birth defects and organic diseases at Love Canal. Two hundred and thirty-nine families were forced to leave their homes as toxic chemicals seeped into soil and water.
Credit: NOVA "A Plague on Our Children"

Love Canal: A Chemical Disposal Nightmare

The Kepone disaster illustrates the potential for harm in unsafe manufacturing practices which release a toxic substance into the air and water surrounding a manufacturing plant. What happened at Love Canal, N.Y., demonstrates the dangers of unsafe land disposal of chemical wastes.

Like Kepone, this disaster built up, unknown, over the years. The seeds of tragedy were sown in the 1920's; the crop of human and environmental misery was harvested in the late 1970's.

Love Canal is a neighborhood of several hundred people living in modest homes just 8 miles from Niagara Falls, N.Y. It derives its name from an unsuccessful attempt by a William T. Love to build a canal connecting the upper and lower Niagara Rivers. After partial construction, the project was abandoned in 1910. In the 1920's, the excavation was turned to a new and dangerous use. It became the site for disposal of wastes for the Hooker Chemical and Plastics Corporation. For 25 to 30 years, chemicals of unknown kind and quantity were buried in this muddy ditch.

In 1953, Hooker, which had put tons of chemical wastes in metal drums into the site, sold the dumping ground to the Niagara Falls Board of Education for $1. The price turned out to be no bargain!

The City of Niagara Falls filled in the Love Canal, then built a school. Developers built a community of modest homes. The seeds of disaster had germinated and were growing . . . but still below ground.

Occasionally, the sprouting ugly plants became visible. Earth would collapse where drums had rotted through; children playing in the muddy fields developed skin rashes and their sneakers developed holes; trees turned black; children played with chunks of phosphorus, throwing them against the pavement where they ignited and flashed bright colors.

By the middle 1970's, the problems began to surface in earnest. The stench was evident. Homes were deteriorating, infiltrated by what proved to be toxic chemicals seeping into basements. People began to complain.

As a result, in the spring of 1978, the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation made an investigation. Results were startling and frightening.

Several children in the neighborhood were born with serious birth defects, such as two sets of teeth, heart defects, and abnormal kidneys. Four mentally retarded children were born to families on one block. Pregnant women miscarried at a rate far above normal. Cases of epilepsy, liver diseases, nervous disorders, rectal bleeding were all above the normal rate. Cancers caused by Love Canal exposure are suspected and can be expected to develop in the years to come.

In August, 1978, the findings were so serious that President Carter declared Love Canal a national emergency area. Two-hundred-and-thirty-nine qualified for permanent relocation—236 left. The homes were boarded up, the school was closed, and attempts were made to clean up the mess.

The State Health Commissioner, in the light of new health surveys and studies of groundwater contamination in surrounding areas, recommended that more families leave their homes, with the State paying for the relocation. These new studies showed that families a block away from Love Canal had the same problems as those living right on the canal: unusually high rates of birth defects, miscarriages, and underweight children.

The State urged that all families with pregnant women or children less than 2 years old in an even larger area around the canal find other housing. There is every reason to believe that adverse health effects are not limited to pregnant women and young children.

No records exist of the kind or amount of chemicals which Hooker Chemicals and Plastics Corporation put into 55-gallon drums and dumped into Love Canal. Hooker manufactured many toxic chemicals. They dumped hundreds of drums. The Federal-State Interagency Task Force on Hazardous Wastes estimates Love Canal contains 21,800 tons of chemicals.

According to EPA, in a statement made by Administrator Douglas Costle in February, 1979, 82 chemicals, 12 of them known or suspected to cause cancer, "percolated up through the soil as their containers rotted." Only the limitations of technology's ability to analyze for and identify the unknown chemicals have kept the list down to 82. Table 1-1 describes some of the more important chemicals identified.

Table 1-1

Love Canal Chemicals*

Following is a list of some of the more important chemicals identified at the Love Canal site and the human biologic hazards associated with them.

COMPOUND	ACUTE EFFECTS	CHRONIC EFFECTS
benzene	Narcosis Skin irritant	Acute leukemia Aplastic anemia Chronic lymphatic leukemia Lymphomas (probable)
toluene	Narcosis (more powerful than benzene)	Anemia (possible) Leukopenia (possible)
benzoic acid	Skin irritant	
lindane	Convulsions High white cell counts	
trichloroethylene	Central nervous depression Skin irritant Liver damage	Paralysis of fingers Respiratory and cardiac arrest Deafness Visual defects
dibromoethane	Skin irritant	
benzaldehydes	Allergen	
methylene chloride	Anesthesia (increased carboxy hemoglobin)	Respiratory distress Death
carbon tetrachloride	Narcosis Hepatitis Renal damage	Liver tumors (possible)
chloroform	Central nervous narcosis Skin irritant Respiratory irritant Gastrointestinal symptoms	

*From "A Special Report to the Governor and Legislature," Governor's Love Canal Interagency Task Force, September 1978.

Documents released by the State in December, 1978, show that a survey by the State in 1978 shows that there are hundreds of chemical dump sites in the Niagara Falls area—some of them larger and potentially more dangerous than Love Canal. Love Canal appears to be only the first of a new and sinister breed of environmental disasters. The dangers nationwide are mind-boggling.

As usual, prevention would have been much easier and cheaper than cure. EPA estimates that in 1953, it would have cost Hooker $4 million (in 1979 dollars) to find, construct, and seal a secure waste facility. So far, not counting human suffering experienced and yet to come, $27 million have been committed in partial clean-up and there are $2 billion in law suits pending against Hooker, other substance or mixture of substances. Concentration is a measure of the amount of that substance as compared to the total amount of all the substances in which it is dissolved, initiated both by government agencies and private citizens.

How Widespread Is the Problem?

> *"The Department of Health, Education, and Welfare's (HEW's) National Institute for Occupational Safety and Health estimates that millions of Americans are exposed to known carcinogens (cancer-causing agents) in their workplaces. It estimates that even more people are exposed to other chemicals and substances which, although non-carcinogenic, can cause fatal or irreversible damage to vital organs or the nervous system."*
>
> —Comptroller General's Report to the Congress
> April 15, 1978

Kepone and Love Canal are not isolated episodes. Other names and other places readily come to mind: PCB's, dioxin, mercury, Valley of the Drums, Silver Bay (asbestos in Lake Superior). But reciting a list of environmental disasters caused by toxic substances does not by itself demonstrate that toxics are a problem of prime national importance.

Four lines of reasoning *do* lead to that conclusion.

1. There is an awesome number and quantity of chemicals used in our industrial society. According to some estimates, there are presently about 60,000 chemicals produced; some 10,000 of these have significant commercial uses. Even worse, this list is being added to at an ever-increasing rate, perhaps an additional 500 to 1,000 a year currently. The production of synthetic organic chemicals has increased more than ten-fold since 1945. The number and amount of chemicals in our environment—used in, among other things, plastics, drugs, paints, pesticides, fertilizers, foods, fibers, dyestuffs, detergents, perfumes, explosives, insulation, pipes, filter media—is staggering. And these chemicals are everywhere—in the air we breathe, in our water, in our food, in the things we touch. Chemical production volume has become so large that disposal of hazardous wastes itself has become a significant threat to health and the environment, as we have seen with Love Canal. EPA estimates at least 1,200 unsafe hazardous waste sites which would cost $3.6 to $6.1 billion for temporary clean-up and $26 to $44 billion for permanent restoration.

2. There is an increasing realization of the role of toxic substances in the environment in the incidence of serious chronic diseases such as cancer and respiratory ailments.

Cancer in this century has gone from eighth to second as a cause of death. Many experts believe that toxic substances play a significant role in this increase. Few reputable cancer specialists dispute the important role of some chemicals in initiating cancers. We shall discuss this important relationship in more detail in a later section.

With our increasing level of technology has come an increasing rate of chronic occupational diseases, including cancer, due to exposure to toxic chemicals. Our preceding discussion of Kepone illustrates the problem.

3. There seems to be an inability to properly control or regulate toxic substances due to our scant knowledge of the risks resulting from their presence in the environment. Belatedly, as environmental disasters have revealed the urgent need for such data, laws such as the Resource Conservation and Recovery Act (RCRA) and the Toxic Substances Control Act (TSCA) have been passed. It is anticipated—or at least hoped—that, as a result, our knowledge bank of data required to assess risk will be increased to meet the need for adequate regulation and control.

4. **The risk from toxic chemicals is non-voluntary and insidious. We have all heard the argument that there is a** risk in everything we do in life—as in motorcycling or smoking—so we should tolerate a risk from chemicals. This argument neglects some important factors. The risk from toxic chemicals in the environment is involuntary; one can choose to smoke or not to smoke, but one cannot choose whether or not to breathe. Further, in the case of toxic chemicals, the person subject to the risk may be deriving no benefit whatsoever from the substance causing the risk, whereas the one deriving the principal benefit (the manufacturer) may suffer no risk.

What is even more important, presence and severity of risk can be very difficult to determine. The risk of a poisonous gas suddenly released from an overturned truck is apparent to all. But many chemicals, especially those causing cancer, give no indication that they are harmful until years after exposure. The danger from toxic substances is magnified because of our ignorance; we don't know very much about what chemicals are in our environment and we don't know very much about which of these chemicals are injuring us.

There can be no question that toxic chemicals in a highly industrialized society such as ours are a prime national problem. Congress has recognized this fact. In 1976, it passed the Toxic Substances Control Act, for the first time providing a mechanism to prevent or control the manufacture or use of chemicals presenting an unreasonable risk. In the same year, the Resource Conservation and Recovery Act was passed to regulate the disposal of hazardous waste.

Unfortunately, passing a law and setting up a bureaucracy to implement the law is no guarantee that the objectives of the law will be attained. Regulation by a government agency is slow, at best. To get results, citizen knowledge and citizen action, properly applied, are urgently needed. It is the function of this handbook to help you get the knowledge and show you how to make your informed opinion heard.

Chapter II Summary

What's a Toxic Substance Anyway?

Chemical and substance mean the same to a scientist. A chemical is either a) an element (one kind of atom), or b) a compound (combination of two or more atoms). A mixture is a non-chemical combination, a mechanical mixing together of two or more chemicals. Concentration is the measure of the amount of a substance compared to the total amount of all the substances in which it is mixed, like 1 teaspoon of sugar in a cup of coffee.

Water is a chemical; salt is a chemical; our bodies are mixtures of chemicals. A chemical can be beneficial or harmful. We drink water; we can also drown in it. Insecticides can injure us or our environment—but would we like living without them?

Some chemicals occur in nature; some are made in the laboratory. In the last 15 years, over 4 million new synthetic chemicals have been manufactured.

Mankind and the environment have adapted to natural chemicals over thousands of years; but exposure to synthetic chemicals is abrupt. With synthetic chemicals, the risk is (1) they are materials foreign to us and our environment, (2) they have unknown, possibly toxic effects, and (3) substantial quantities could enter the environment. One safeguard in dealing with synthetic chemicals is adequate testing before release.

Congress has defined a toxic substance as a chemical or mixture whose manufacture, processing, distribution, use, or disposal may present an *unreasonable risk* of injury to health or the environment. Pollutants are contaminants in the environment; those which present unreasonable risk are toxic substances.

Risk is measured by a) the inherent toxicity of the chemical and b) the amount of exposure. The first is determined by toxicological testing (usually on animals). The second is determined by getting information about how much gets into the environment, what happens to it once it gets there, and what hazards it presents from the time it enters the environment until it disappears (if ever). Then we can decide if we will be better off with it than without it—the only reason for knowingly taking a risk. This is the purpose of environmental impact statements and cost-benefit analyses.

Whether a risk is reasonable is usually a value judgment, not a fact, and it too often is based on whose ox is being gored.

CHAPTER II

What's a Toxic Substance Anyway?

What Is A Chemical?

To a scientist, the word "chemical" and the word "substance" are synonymous and can be used interchangeably.

We all know, in a general way, what a toxic substance or toxic chemical is. A more precise knowledge of the terms is desirable to understand the problems of toxic substances. For example, advertising campaigns have been conducted by industrial firms whose theme is that life would be impossible without chemicals (true), implying that these very same kinds of chemicals are the ones being used for "Better Things for Better Living Through Chemistry" (not quite so true). Our discussion will shed light on such issues.

Our high school chemistry taught us that everything in our world is made from fundamental building blocks called atoms. These atoms make up elements—such as oxygen, carbon, or lead—when only one kind of atom is present; or compounds—like water, sugar, or Kepone—when two or more atoms are combined chemically. Compounds range from extremely simple, such as common table salt—a union of one atom of sodium and one atom of chlorine—to extremely complicated, containing thousands of atoms—such as proteins and plastics.

A chemical, or substance, may be either an element or a compound. All elements and all compounds are substances.

A mixture is a non-chemical combination, a mechanical mixing together, of two or more chemicals.

One further useful definition. Inorganic chemicals are chemicals containing no carbon atoms. Organic chemicals contain carbon atoms. This differentiation stems from a mistaken belief once held by chemists but abandoned many years ago, that only living organisms can produce compounds containing carbon. The classification is useful, since the unique ability of the carbon atom to combine with itself opened the vast vista of organic chemistry. Literally millions of organic compounds are known.

Since atoms are the building blocks of matter, and since atoms combine to form chemicals, it follows that our entire material world consists of chemicals: elements, compounds, and their mixtures. Human bodies, food, mountains, trees, furniture, automobiles—they are all mixtures of chemicals.

In short, our entire world consists of chemicals. Water is a chemical; salt is a chemical; sugar is a chemical; foods are mixtures of chemicals; our very bodies are mixtures of chemicals. Life without certain chemicals is impossible.

Most chemicals we can live without, but life may be more pleasant with some of them: aspirin, ethyl alcohol, DDT, titanium oxide (a whitener in paint), tungsten (filament in electric lightbulbs) are examples.

But the chemical coin has two sides. Those same chemicals may have the capacity to injure and even kill us or to foul our environment.

Chemicals may be—and usually are—both toxic and beneficial, both good and bad. Toxic effects are of all kinds; they may occur quickly or show up many years after exposure; they may affect people or plants or animals or fish or birds; they may affect the nervous system, the reproductive system, eyesight, vital organs; they may be mild or severe.

Salt can contribute to high blood pressure; sugar is toxic to diabetics; iodine, essential to life in small amounts, is a deadly poison in higher amounts; even water, under some conditions, is harmful. Gasoline, aspirin, insecticides can injure us or our environment—but would we like living without them? We are faced with a dilemma.

Chemicals: Natural or Man-Made?

"...scientific knowledge about the effects of chemicals cannot keep up with the ability of industrial laboratories to create new ones."

—U.S. Court of Appeals for the District of Columbia.

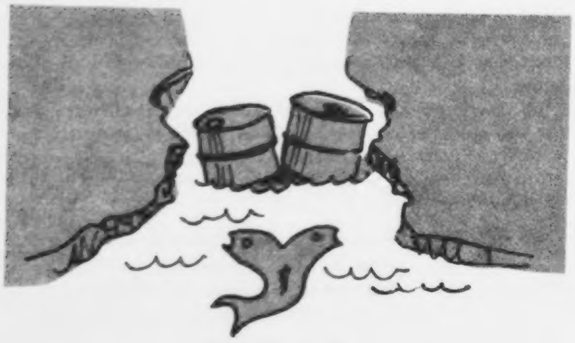
Our entire world is composed of chemicals, thousands upon thousands of them. Each is different, yet there are similarities. If we are to decide upon their benefits and their dangers, it is essential to find ways to classify these chemicals into manageable groups.

Such grouping can be done in various ways, depending on the purpose or the criteria used for the classification. Substances can be classified, for example, as to whether they are toxic or nontoxic; whether they are organic or inorganic; by chemical composition or structure; by physiological activity.

In discussing toxic substances, an important classification is the origin of the chemical. Is the substance "natural" or does it come from the laboratory?

Mankind and the environment—the air, the land, the waters, animals, and plants—have evolved over millions of years. During this long evolutionary process, thousands of chemicals have formed in nature, supplying a natural need or resulting from a natural process. All living organisms either adapted to these natural chemicals as they occurred in nature or became extinct. The natural world about us is in balance at any given point in time. As time passes, this balance slowly changes; this is the evolutionary process which results in the "natural selection of species."

But mankind has intervened in this delicate balance. The use of fire, the domestication of animals, the building of cities and factories, all affected "natural selection."



The industrial revolution and its effects are well known. Not so well known is the profound impact of the "chemical revolution." Ever since man first used fire, he has been altering the environment by altering chemical substances. Physical processes, such as boiling, compressing, and mixing, change the *form* of objects; chemical processes, such as oxidation (or combustion or burning) or polymerization [making a complicated multi-block chemical (polymer) from simple building blocks (monomers)] change the basic chemical structure of the object. Only in the past few hundred years have we begun to understand chemical processes and to use them in a systematic way to accomplish specific tasks.

In 1828, a chemist working in a laboratory for the first time fashioned (synthesized) an organic chemical formerly made only by nature. Soon, chemists were synthesizing chemicals never before found in nature. The number of such man-made, or synthetic chemicals started as only a trickle, but as chemical knowledge increased, the trickle became a torrent. The chemical revolution took place at an ever increasing pace, especially since World War II.

It is estimated that, between 1965 and 1979, well over 4 million new chemicals were prepared in the laboratory which do not occur in nature. The list is growing at the rate of 6,000 per week, or 1 million every 3 years. The vast majority of these are laboratory curiosities, but EPA estimates place the number of chemicals being used industrially in the United States as 70,000. A high percentage of these are synthetic, man-made. EPA further estimates that perhaps 1,000 more synthetic chemicals are being introduced each year in the United States.

So, in the course of about 150 years, we have changed from a world consisting of only natural chemicals to a world with two classes of chemicals, natural and synthetic, with many more synthetic chemicals than natural ones. Many natural chemicals can be synthesized. Such chemicals are classified as "natural."

Why is this distinction between natural chemicals and synthetic chemicals important to an understanding of the toxic chemicals problem? As we have mentioned, all living things have adapted to their environment. There is a vital difference between chemicals to which mankind and the environment have become adapted over thousands of years and synthetic chemicals to which man and the environment are abruptly exposed.

The difference is one of kind, not simply of degree. This is not to say that a natural chemical cannot be toxic. Indeed it can. Carbon monoxide gas, arsenic, rattlesnake venom—these are examples of natural chemicals or mixtures just as are water, sugar, and clay.

The important characteristic of "natural chemicals" is that we have adapted to them *provided they are present in the place and in the amount found in nature,* e.g., rattlesnake venom in the fangs of the rattlesnake. Adapting involves both the ability to use substances in the environment and to avoid those which might prove harmful. We need to be concerned with the effects of natural chemicals only when they are present in an amount higher than and in a form different from that found naturally.

The situation is quite different with synthetic chemicals. Subjecting living things to materials never before present in their environment is a risk not to be taken lightly. A precaution taken in the space program points out dramatically the potential for serious consequences. When astronauts first set foot on the moon, scientists had grave fears that they might bring back organisms from the moon not present on earth. An organism foreign to the earth might be toxic; man, animal, or plant would have no "natural resistance" to its effects. It was conceivable that such an organism could reproduce here on earth and initiate a catastrophic epidemic.

Note the three essential components to this potential catastrophe: (1) material foreign to man and his environment, (2) unknown, possibly toxic effects, (3) ability of the foreign material to reproduce, so that substantial quantities could enter the environment.

As a consequence of these fears, the astronauts and all the moon material they brought back were kept in quarantine until scientists were convinced by exhaustive testing that there would be no adverse effects upon releasing the men and materials.

Synthetic chemicals pose the same potential risk: (1) they are materials foreign to man and his environment; (2) they have unknown, possibly toxic effects; (3) substantial quantities could enter the environment.

It is true that synthetic chemicals are not alive, so they cannot increase in amount by reproducing. But the effect of going from fractions of an ounce in a chemical laboratory to the production of tons of the chemical in a factory is quite similar in effect to an increase by reproduction.

The message is clear. While a chemical's toxicity is not determined by whether it is natural or synthetic, synthetic chemicals are more likely to pose a risk of harm. The continued proliferation of synthetic chemicals requires ever increasing vigilance on our part to protect ourselves from harm.

There is one most important precaution: adequate testing before release. And we will talk about testing in more detail later.

Natural chemicals (such as asbestos) can be toxic when they are present in a form, or in an amount outside of the limits found naturally. More generally, a chemical (natural or synthetic) may be toxic when its *concentration* is too high. Adverse health effects may result when the concentration of a naturally occurring chemical necessary for life, such as oxygen or salt, becomes *too low*. However, in an industrial society, undesirable effects most often result from too much of a chemical, not too little.

A scientist talking about the concentration of a substance is referring to a situation in which that substance is dissolved, mixed, or otherwise distributed throughout some mixed, or otherwise distributed.

So, we can talk about the concentration of sugar in coffee, saying there is 1 teaspoon of sugar per cup or 2 teaspoons per cup. Since cups vary in size, and since scientists deal in precise measures of weight or volume, the scientist would say that there are, for example, 2 grams of sugar per 150 milliliters of coffee, or the concentration of sugar is 2g/150 ml.

Another way of expressing concentrations is commonly used for substances which have an effect on living things even at very low concentrations: parts per million (abbreviated as ppm). One ppm arsenic in the bloodstream means that the weight of a blood sample is 1 million times that of the arsenic in the sample. As measuring, or analytical, techniques have become more sensitive, ppb (parts per billion) are commonly used. Or concentration may be expressed in percentage; thus, air is approximately 20 percent oxygen (by volume).

What Is a Toxic Substance?

> *"Toxicology . . . provides a bridge between the chemical and the biological worlds, and we must comprehend the strength and weaknesses of that bridge before entrusting to it the weight of decisions that will affect not only our own lives, but those of future generations as well."*
>
> *—Cleaning Our Environment, p. 81,*
> *American Chemical Society,*
> *2nd Edition (1978)*

Defining a toxic substance is not easy. Congress, in passing the Toxic Substances Control Act (TSCA), avoided an explicit definition. Not only does the Act not define "toxic substance," but except in the title of the Act, the phrase appears nowhere in the Act. The U.S. Environmental Protection Agency (EPA), which has the responsibility of enforcing the Act, stated, "The main obstacle is the lack of a precise or even semi-precise definition of what constitutes a toxic material. The line of demarcation between a toxic and a nontoxic material is so ambiguous that it is almost hopeless . . ." ("Report of the Integrated Toxics Strategy Work Group," EPA, April 1, 1977, p. 38.)

In the broadest sense, a toxic substance is one which can produce some adverse biological effect or damage in a living organism; be it man, animal, plant, or whatever. But this definition is not very helpful. Every chemical can be toxic if too much of it is present, that is, if its concentration is too high for the particular circumstance. Water is toxic to a person submerged in it. It has been well said that there are no harmless substances, only harmless ways of using substances. It is just as valid to state that there are no toxic substances, only harmful ways of using substances. Strychnine is harmless so long as it is kept within a sealed ampoule.

TSCA recognizes this situation and attacks the problem of protecting human health and the environment by stating:

"The Congress finds that—

(1) human beings and the environment are being exposed each year to a large number of chemical substances and mixtures;

(2) among the many chemical substances and mixtures which are constantly being developed and produced, there are some whose manufacture, processing, distribution in commerce, use, or disposal may present an unreasonable risk of injury to health or the environment; . . ."

By indirection, Congress thus defines a toxic substance as a chemical or mixture whose manufacture, processing, distribution, use, or disposal may present an unreasonable risk of injury to health or the environment. Such substances or mixtures are the ones to be regulated.

The key words in this definition are "unreasonable risk."

Pollutants and Toxic Substances

The terms "pollutant" and "toxic substance" are often used interchangeably. Such usage is convenient but imprecise and sometimes misleading.

Just as all dogs are animals, but not all animals are dogs—all toxic substances are pollutants, but not all pollutants are toxic substances. Pollutants, in the broadest sense, are all materials which enter the environment as a direct or indirect result of man's living on earth. Pollutants thus include human biological wastes, garbage, the smoke from cigarettes and from factory smokestacks, the emissions from homes, offices, vehicles, and industrial plants. There are oxides of nitrogen naturally present in the atmosphere; to the extent automobiles increase the amount, these oxides are pollutants. There is salt dissolved in rivers; to the extent that salt was put there by factory wastes, salt is a pollutant.

Pollutants may or may not be harmful to human beings and the environment, may or may not be harmlessly absorbed by the environment. Not so with toxic substances. A pollutant is a toxic substance when it causes an "unreasonable risk" to human health or the environment.

Improper disposal of toxic wastes imperils human health and the environment. The Congress is trying to create a fund to clean up hazardous waste dumpsites.
Credit: Sandy Jerabek, NWF

Pollutants, then, are contaminants in the environment. Those pollutants which present unreasonable risk are toxic substances. Deciding which pollutants are toxic substances can be complex and difficult, as we shall see.

Which substances are toxic? The consent decree.

There are tens of thousands of chemical compounds in commercial use. According to a Congressional staff memorandum in 1977 (Congressional Record, Vol. 123, No. 197, p. H 12929, Dec. 15, 1977): "12,000 compounds are already suspected as being toxic, 1,500 are suspected carcinogens, and countless others are considered capable of producing various human health and aquatic species disorders."

Knowing or suspecting that compounds are toxic is only the first step toward regulating or controlling their use. The fact is that, for a variety of technical, legal, economic, and social reasons, very few compounds have been officially designated as toxic substances and have been regulated in any way. For example, by 1977 only six substances (aldrin, dieldrin, endrin, DDT, toxaphene, benzidine, and PCB's) were characterized as toxic by EPA under Section 307(a) of the Clean Water Act, and some of these were being contested in Federal court.

By 1977, EPA had published water quality criteria for only 40 compounds. According to an EPA official, at best it takes 5 to 10 years after such publication before regulatory rules can be issued.

In view of the slow progress by EPA in regulating toxic substances, two environmental organizations took court action against EPA. A settlement agreement resulted, often referred to as the Toxics Consent Decree. Under terms of this consent decree, EPA was required to issue technology-based treatment standards regulating 65 compounds or chemical classes, later expanded to 129 specific chemical compounds, as priority toxic pollutants. According to the decree, EPA was given until May 8, 1981 to issue these regulations.

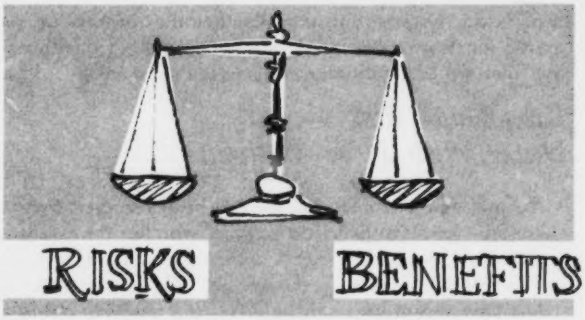
Appendix I-1 lists these 129 Priority Toxic Pollutants.

Examination of this list of toxic pollutants illustrates the difficulty a person not chemically trained experiences in a discussion of specific toxic substances. To a chemist, the list is susceptible of rational categorization (see Appendix II-2). The bulk of the compounds on the list are halogenated aliphatic or aromatic hydrocarbons, ethers or phenols; nitrophenols, nitrosamines, phthalate esters; polynuclear aromatic hydrocarbons; pesticides; and heavy metals. As we will discuss in the section on screening, compounds belonging to these categories deserve close scrutiny.

In the case study of New Jersey, we shall take one particular chemical (decabromodiphenyl oxide) and show how its potential effect on human health and the environment is evaluated.

While lists such as the 129 toxic pollutant list are of considerable practical use, it should be remembered that such lists are neither all-inclusive nor cast in concrete. The Administrator of EPA has the authority to add to or delete from the list.

Most important for you to keep in mind is that, if not for interested people like you, acting through citizen groups, the toxic pollutant list would not exist.



What is Safe? The Risk Concept.

Whether or not a substance is considered to be a toxic substance depends on whether it presents an "unreasonable risk" to health or the environment. It follows that there are "reasonable risks." How is the determination made that a risk is reasonable or unreasonable to society?

First, the magnitude or severity of the risk must be assessed. Second, the potential benefit to society is estimated. Then the decision makers balance risk against benefit and decide whether the risk is reasonable or not. We will discuss this process more in a later section. In this section we shall confine ourselves to the first step, risk assessment.

Two factors taken together measure the risk: (1) the toxicity of the substance, the damage the chemical could cause if man and the environment were exposed to the chemical, and (2) the extent of exposure. In other words, what kind of damage and how much?

Determination of the toxicity of a substance is the function of toxicological testing. Such testing is performed under carefully controlled conditions in a laboratory, using appropriate test species, such as mice, dogs, fish, birds, plants, or microorganisms. The tests must be carefully designed in order to determine how much and what kind of damage is done to the test organism by its exposure to definite amounts of the chemical over a known period of time. There are generally accepted procedures for translating results on test organisms to human beings.

Properly conducted toxicity tests will enable the toxicologist to estimate the lowest concentration level of the chemical which will cause a harmful effect, and the severity and kinds of effects at that and at higher levels.

In order to assess environmental and health impacts, toxicological testing must be supplemented by information on the expected environmental distribution of the substance. It can't hurt you if it doesn't get to you!

So a list of questions needs answering. How much of the chemical will be produced? How will it be used? Will it get into the air, into the water, on the land, into food? If it gets out into the environment, will it be transported by the wind, by streams, be eaten by fish? Is it stable? Does it vaporize? Is it biologically magnified in a food chain, such as plankton—fish—bird—maybe man? And so on. What is needed is a knowlege of how much gets into the environment, what happens to it once it gets there, an evaluation of the hazards presented by the substance from the time it enters the environment until it is disposed of or converted to harmless products.

Combining toxicity information with information on environmental concentrations permits assessment of risk to health and the environment. Whether the information required for this assessment is available is another question—one that we will postpone considering until later.

Reasonable Risk—Better With It or Without It?

Assume that a risk assessment has been completed for a chemical. Now it must be determined whether the risk is a reasonable one. Making such a decision is far more difficult in the real world than in theory. Let's look at the theory.

The only reason for knowingly taking a risk is to obtain a benefit.

Unfortunately, knowing that a risk is being taken is frequently not obvious. Those who bought houses in Love Canal did not know they were taking a risk from chemical wastes buried underground. Years ago, workers painted hands of clocks with radioactive paint to make them visible in the dark; they did not know they were risking cancer by bringing the paint brush tip to a point by putting it between their lips. Science with unpleasant frequency is uncovering risks of which we had been unaware. Even when we are aware of risks, the exact nature, severity, and probability of possible adverse effects are seldom known precisely.

We can generalize that the taking of a risk implies some derived benefit—and vice versa. Two factors, often overlooked, complicate this generalization. These two factors, though different, are often related.

First, the taking of the risk may or may not be voluntary. A skier voluntarily risks broken bones. A smoker willingly risks his health. But a hayfever sufferer is forced to breathe pollen—or move to a pollen-free location. A person is forced to ingest any toxic substances in his water supply—or buy other water.

Second, the person at risk and the person deriving the benefit may not be the same person. The person ingesting toxics in his drinking water takes the health risk. The persons putting the toxic substances into the water derive the benefit.

In practice, these concepts can become quite controversial. Presently, the government is trying to set up a fund to clean up existing dump sites containing hazardous wastes. Who is to supply these funds? It has been proposed that chemical manufacturers be taxed for this purpose, since their profits are derived in part from their not having paid for safe disposal of the wastes. The chemical industry asserts that all society benefits from the use of chemicals, so funds should come from general taxes. Can one equate the voluntary nature and the magnitude of the benefits and the risks taken by a resident in the Love Canal with the voluntary nature and magnitude of the benefits derived and the risks taken by Hooker Chemical Company?

Few would question that, in making decisions about toxic substances, both the benefits and risks resulting from the decision must be considered. It would seem reasonable to adopt some rule balancing the benefits and risks. For example, TSCA uses the criterion of whether a risk is reasonable or unreasonable. "Environmental impact statements" and "cost-benefit" analyses are receiving more and more emphasis as a way to determine the effects of a decision or action and what decision to make or action to take.

Again, few would question the advisability of learning all one can about the effects, good and bad, of an environmental decision. But how one uses the information obtained will not get the same consensus.

"Facts" are not always what they seem. Statistics can be used, misused, or abused in interpreting data. Uncertainty lies like dense fog over the entire procedure—uncertainty in selecting the relevant facts, uncertainty in quantifying costs, uncertainty in quantifying benefits, uncertainty as to who benefits and who suffers, uncertainty as to the value of jobs as compared to health, uncertainty as to the effect on technological innovation or the closing of plants—the list is lengthy.

The theory is simple. Put benefits on one side of a scale, costs on the other; see which way the scale tilts. Putting the theory into practice is devilishly difficult. More of this in a later section on "cost-benefit."

The important thing to remember is that whether a risk is reasonable or not is usually a value judgment, not a fact, and depends all too often on whose ox is being gored.

Chapter III Summary

TOXIC EFFECTS

Toxic substances cause problems when they are absorbed by living organisms through skin contact, eating, drinking, or breathing. Toxics can cause damage directly to the surface of the body—skin, eyes, hair—and they can pass through the skin.

Epidemiology is a systematic way of tracing a disease by the pattern of what people get the disease—their age, their sex, where they live, where they work.

Since people cannot be exposed experimentally to possibly dangerous chemicals, we test on animals. Rats are most frequently used because biologically they handle substances much like people do, and their use is relatively inexpensive. After chemicals are fed or injected, the rats are rigorously observed to catch any abnormality.

Test animals are exposed to much higher doses than the low levels anticipated for human exposure, because chronic effects induced by low levels over a long period of time may also be produced by higher levels over a shorter time.

To identify those chemicals most likely to be toxic, gross screening tests are made by applying chemicals to bacteria. Since cell reproductive structure and function are universal among all animal cells, if a chemical damages the DNA in bacteria, it is a strong signal the chemical may cause cancer, birth defects, or altered genes. Such a chemical should then be tested on animals.

Another signpost is that compounds are more likely to be toxic if their molecular structure is similar to that of other compounds known to be toxic. About 90% of chemicals tested show no evidence of cancer effects.

Carcinogen: substance causing cancer (the appearance and proliferation of abnormal cells)

Mutagen: substance causing a change in the genetic material—inheritable from cell to cell, but not necessarily from individual to individual

Teratagen: substance which changes the embryo, resulting in birth defects, e.g., thalidomide.

Of 400,000 annual deaths from cancer, it is claimed that one-fifth to one-third are due to occupational exposure to carcinogens. Beyond the workplace, we involuntarily come in contact with a variety of carcinogens. Unlike other kinds of toxic substances, there is no proven safe level (no-effect dose) for a carcinogen. The Food, Drug, and Cosmetic Act prohibits putting into food *any* amount of a chemical additive shown to cause cancer in people or animals.

CHAPTER III

Toxic Effects

How Are We Exposed? Let Us Count The Ways

Toxic substances cause no problems until and unless they touch or are absorbed by living organisms. Such interaction arises most commonly by skin contact, ingestion into the digestive tract, or by inhalation during breathing. Exposure may be voluntary (cigarette smoking) or involuntary and occur anywhere—at home, in school, while swimming, at work (occupational exposure is an extremely significant problem), or at play.

Direct External Contact

The surface of the body—the skin, the eye, the hair and scalp—can be damaged by direct exposure to toxic substances. Even more importantly, many chemicals pass through the skin and spread through the body.

We can come into direct contact with toxic chemicals in a variety of ways. For example, we use cosmetics: some hair dyes are carcinogens. Exposure occurs accidentally in the household, especially with children exploring where they shouldn't. However, the principal route for damage by direct contact with chemicals is by occupational exposure. We have seen earlier how employees of a plant manufacturing Kepone were poisoned by direct contact of Kepone with their skin.

Research has shown the surprising ability of chemicals to pass through the skin and enter the system. The population most at risk are industrial employees at their workplace, farm workers using pesticides and other agricultural chemicals, and those living in areas sprayed with those chemicals.

Is It Safe To Breathe?

Toxic chemicals can enter the bodies of human beings, animals and plants through the air.

"Pure" air is a mixture of gases, principally nitrogen, oxygen, carbon dioxide, and water vapor. Man's activities have introduced a host of other chemicals. "Air pollution" has become a household phrase. In this regard recall our discussion of pollutants and toxic substances (pp. 10-11). There are many pollutants in the air, substances such as oxides of nitrogen, sulfur dioxide, carbon monoxide, finely divided particulate matter, and hydrocarbons. These are not toxic substances as defined by Congress, even though they can and do cause toxic symptoms, serious disease, and even death.

Toxic substances can also be airborne. Volatile chemicals like vinyl chloride and ethylene dichloride; metals like lead and cadmium; pesticides like DDT and Kepone; particles like asbestos can enter living organisms, including ourselves, adding to the environmental insults we receive through other media.

These airborne chemicals enter the body either through the lung, or in the case of lower animals, fish, and plants, through other air-exchange mechanisms. The chemicals may then be transported to other parts of the body, stored, metabolized, or excreted.

Is It Safe to Eat?

Another route by which toxic chemicals can enter living things is through the digestive system, or in the case of plants, through their root systems.

So long as ingestion is restricted to foods human beings in the United States eat, toxic substances pose relatively little risk from the intentional addition of chemicals, thanks to the Food, Drug, and Cosmetic Act. Under this Act, no chemicals (so-called food additives) can be added to foods or beverages unless their safety has first been demonstrated. Proposed food additives are considered to be guilty until adequate testing demonstrates they are innocent in the amounts proposed for their food use. In general, so-called cost-benefit considerations are given no weight in deciding whether a chemical can be added to foods and beverages.

Depite the precautions taken with foods, disasters sometimes take place. In the middle 1960's, there was an epidemic of severe heart illnesses and some 40 deaths in the United States and Canada among men who drank large amounts of beer. The episode was attributed to the use of cobalt salts in trace amounts (up to 1.2 parts per million) as a beer foam stabilizer. Authorization for such use had been granted in both the United States and Canada on the basis of previous use of cobalt salts as an anti-anemia drug and experimental

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The principal route for damage by direct contact with toxic chemicals is by occupational exposure. Credit: EPA DOCUMERICA subacute feeding of rats with cobalt salts. The effect of these cobalt salts in beer was completely unanticipated. Some unknown synergist was probably involved.

Besides being in foods, chemicals can enter the body through the mouth in drugs and medicines. In this case, benefits are balanced against safety; an anti-cancer drug need not be as free from adverse side effects as an anti-headache medicine.

Toxic chemicals are ingested in other ways, also. Children eat pieces of lead-based paint on plastered walls. Tris, which causes cancer, was used as a flame-retardant on children's clothes.

Safety of drinking water (other than bottled water) in the United States does not fall under the Food, Drug, and Cosmetic Act; it is subject to the Safe Drinking Water Act. Toxic problems arising from drinking water will be discussed in the New Jersey study.

Injection

Toxic substances can enter the body by direct injection from a syringe into the skin, the bloodstream, or elsewhere in the body. This mode of entry is of concern to us only by reason of the fact that chemicals are sometimes tested for safety by injection into animals. More on this in the section on toxicity testing.

Testing

By now you realize that deciding whether a chemical is toxic is no simple matter. The amount of the chemical, how it enters the living organism, the severity and kinds of harmful responses to the chemical, how long it takes to bring about the responses and its reversibility—all these factors and more must be considered.

In this section we will discuss the methods by which toxicity can be estimated, their advantages, limitations, and inherent uncertainties.

Voluntary Tests on Human Beings

At first blush, it would seem that if we want to find out if a chemical is safe for human beings, we should test it on human beings. Similarly, if we are concerned about fish, dogs, geese, or plants, we should test fish, dogs, geese, or plants.

Not necessarily so. Testing difficulties using human beings usually present insurmountable obstacles. Most important are the ethical considerations. We simply cannot expose people, either on a voluntary or involuntary basis, to the unknown dangers of ingesting or inhaling chemicals possibly hazardous to their health. Even if we could, there would be serious problems in doing so in a controlled way, that is, in known concentrations for known and possibly lengthy time periods.

Acute toxicity testing requires determination of the dose needed to kill a percentage of the test organism; chronic testing requires complete autopsies of some of the animals under test. Here again, human beings must be ruled out as a test species.

There are two limited areas where voluntary human testing is possible. The first is the determination of the possibility of skin irritations by contact patch tests. The other is controlled clinical testing by physicians of drugs, using patients whose consent has been obtained.

How often have we heard it said that a particular substance must be safe because nobody has ever proved that a single person was ever harmed by it? Such a statement displays ignorance or worse.

People do not live under controlled laboratory conditions. They change jobs, they move from place to place, they eat different foods. Who is able to say what part, if any, a particular chemical in the environment played in the incidence of a disease in an individual or in a group of individuals? In our complex industrialized society, singling out a health effect as due to the long term effect of low levels of a specific chemical in the environment is exceedingly difficult.

The science of tracing a disease by the pattern of what people get the disease—their age, their sex, where they live, where they work—is called epidemiology. The complexity of most epidemiological studies is difficult to overstate. The cost of the studies can be astronomical. Think of the time spent, the money and effort expended on the study of cigarette smokers, or the effect of saturated fats in the diet.

Epidemiology does have a place. It can alert society to a problem. Studies of the relative geographic incidence of specific types of cancer tied in with the types of industries in areas of high incidence can, for example, give leads to problem chemicals. Epidemiological studies are useful to corroborate other lines of evidence. Cigarette smoking is a good example.

But epidemiology suffers from a fatal flaw. At best, it locks the barn door after the horse is stolen. Epidemiology points the finger of blame only at the culprit which has already struck repeatedly.

Who Cares If A Rat Dies?

"Predictions of toxicological hazard to humans are derived for the most part from controlled studies in animals. The few exceptions involve substances whose effects already are well understood."

Cleaning Our Environment. A Chemical Perspective.
The American Chemical Society

The tests most likely to be useful in predicting toxicity in man are tests on living organisms other than man. Laboratory animal testing is by far the most powerful and generally accepted tool available. You can be quite sure that anyone who tries to deny the toxicity of a chemical by stating, "It may harm a rat, but it's never harmed a person," is either uninformed or has some vested interest.

True, toxic effects often vary from species to species. True, tests on animals are not 100 percent conclusive as to human beings. But, in biological effects, nothing is 100 percent certain. Properly planned experiments on animals have demonstrated their general applicability in predicting toxicity to human beings. Such tests, buttressed by other lines of evidence, rightly serve as a basis for regulatory control.

Why the Rat?

The species of animal to be used for toxicity testing is one of the many important decisions that must be made to maximize the usefulness of the test.

If the test results are going to be used to predict toxic behavior in human beings, an animal that handles the substances biologically as much like a person as possible is desired. (In estimating the environmental impact of a chemical, the toxicity of a chemical, to, say, fish and waterfowl may be tested because these species will be at risk). While professional experience is needed for guidance, the actual decision may be based on practical economic considerations. The use of monkeys, dogs, large animals in general, is very expensive. Common practice is to use rats (or mice) for most chronic tests. Dogs are usually used if a second species is needed.

How is the Chemical Given?

Toxic chemicals can exert their effect by absorption from the lungs, the digestive tract, or the skin. Correspondingly, tests can be performed by incorporation of the chemical into the food or drink of the test animal, into the air it breathes, or onto the skin. In special cases, such as when the animal will not ingest the chemical because of its taste or odor, the chemical may be injected.

As a practical matter, most testing laboratories are set up mainly for so-called feeding studies, and so most chronic studies incorporate the chemical into the diet of the animal. Inhalation and injection are used less frequently.

Studies are sometimes criticized because an inappropriate method of administration was used. While this criticism may sometimes have merit, often this argument is resorted to by those seeking any possible reason for attacking results threatening their interests. The validity of any particular study should be considered on its merits.

How Long a Test?

Animal studies may be acute (single dose), subchronic (repeated dose), or chronic (long-term). The length of the study will depend on the chemical evaluated, how the chemical will be used and by whom, the expected production volume, what is known toxicologically about related chemicals—indeed, every known fact about the chemical must be combined with expert professional judgment and societal needs to decide what testing should be done.

Acute tests are usually designed to find the size of the dose required to produce a specified symptom in 50 percent of the animals tested. For example, let us suppose that the test species is the rat and that the specified symptom is death. Then the acute test determines the size of the dose required to kill 50 percent of the rats subjected to that dose. This dose is called the median lethal dose, LD_{50}. (See Appendix III-1). LC_{50} is the median lethal concentration. LC_{50} is frequently used in testing aquatic species.

Subacute or subchronic tests are similar to acute except that doses are repeated, usually daily, for several days to several months. Subacute testing is designed to establish the various adverse effects produced by the chemical and the approximate minimum doses that cause each such injury. In addition, a solid basis is acquired for a decision as to what concentration levels should be tested if a chronic study is run.

Chronic studies run for about 2 years, the lifetime of the rat. This same 2-year period is also used even if the test animal is long-lived, such as the dog or monkey. Chronic studies permit detection of chronic low-level effects, such as cancer and blood vessel deterioration.

A full scale chronic toxicity study is expensive. Detailed planning and execution are required, using a team of toxicologists, pathologists, statisticians, biochemists, hematologists and possibly geneticists, nutritionists, and others.

Once the test is underway, each animal is subject to rigorous scrutiny. Every clue to abnormality is sought, ranging from a daily record of the food and water ingested and the weight of the animal, to sacrificing (killing) the animal and subjecting it to autopsy, including both a gross anatomical study (size and condition of organs, etc.) and a microscopic examination of tissue slides of every significant portion of the animal. Samples of blood, urine, and feces are examined. Behavior of the animals is observed. The goal is to detect any abnormality, be it tumor, heart damage, slowed weight gain, nerve damage or whatever. The incidence of these abnormalities as the test proceeds is compared for the different levels; differences which are statistically significant are sought.

How Much to How Many?

Acute toxicity testing imposes no great problem as to the number of animals tested. From experience, the toxicologist knows how many animals there should be for each dose level and how many and what dose levels are needed. The expense of acute testing is sufficiently low that if additional testing turns out to be desirable—using a larger number of test animals or different exposure levels—such repetition is feasible.

The situation with subchronic tests and especially with chronic tests is quite different. Since the cost of a 2-year rat study on one chemical is estimated at somewhere around one-quarter to one-half million dollars, such a study must be done right the first time. Furthermore, since the cost of the test goes up almost in proportion to the number of test animals used, the number of test levels and the number of test animals must be minimized to the greatest extent possible.

First, there must be a zero level, a control group of animals treated exactly as the other animals tested except controls receive none of the chemical being evaluated. The health of these animals is the standard against which the condition of the rest of the test animals is measured.

The selection of other levels is made using results of acute and subacute tests as a guide. A subchronic study includes a no-observed-effect level, a severely-toxic-effect level, and two, three, or more intermediate levels. Levels for a chronic study are generally not decided upon until the results of the subchronic study (usually 3 months using rats) are completed. Usually there are three or four levels: control, clearly toxic, and one or two intermediate levels.

Two very important points are often overlooked by the non-professional. A chemical which can produce a chronic disease in a human being exposed to low levels for a lifetime cannot be relied upon to produce any observable effect on short-lived animals (like rats) at the same low level. Furthermore, testing procedures must be restricted to small groups of animals, perhaps a few hundred. Yet the results of the tests will be the basis for protecting the health of hundreds of millions of people.

Consequently, test animals are purposely and justifiably exposed to much higher doses than the low levels which may be anticipated for human exposure.

Scientific experience has demonstrated the soundness of the basic assumption underlying the technique of using relatively high chemical levels for chronic studies: chronic effects induced by low levels over a long period of time may also be produced by higher levels over a shorter time.

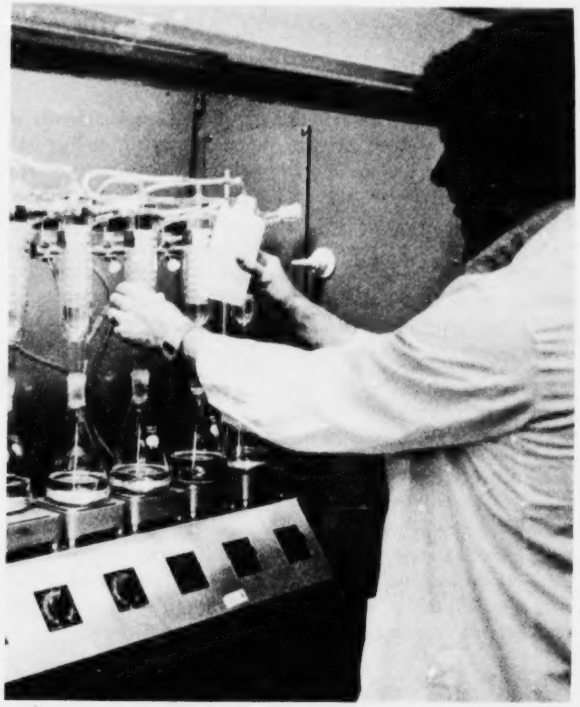
The actual levels to be used in a particular study and the number of animals tested at each level require the highest degree of scientific and statistical competence, so that the results can be extended or extrapolated with some level of confidence to the individuals to be protected.

These considerations are of special significance when applied to testing for carcinogenicity (the ability to induce cancers). We shall discuss this matter more in the section on cancer.

What Can We Conclude? Is the Jury Still Out?

The American Chemical Society states precisely and accurately:

> "The goal of an animal study is to determine in the laboratory the dosage and conditions of exposure that will produce the toxic effects on the species and to use this information to predict what may occur in real-life situations in the same or another species, including humans."—*Cleaning Our Environment. A Chemical Perspective.* 2nd Edition, 1978, American Chemical Society. p. 83.



Chemicals should be submitted to thorough toxicological testing to ensure appropriate evaluation and regulation. Credit: EPA

Knowledge of the acute toxicity of a chemical is useful in two distinct ways. First, it gives us a benchmark on the safety of short-term exposure to the chemical. If people are exposed to the chemical briefly and occasionally in their occupation (a chemical production worker or a farmer spraying a pesticide), a low LD_{50} calls attention to the necessity for suitable protection, such as respirators or protective clothing.

Second, high acute toxicity is a red flag, warning us to obtain additional information, such as chronic toxicity and effect on wildlife. Use of short-term tests as a screening device will be discussed in more detail later.

In acute testing, the cost and time taken for the test are low enough that results can be obtained for more than one species. If the result does not vary much from species to species, it can be assumed that the LD_{50} is probably applicable to human beings.

If, however, LD_{50}s vary considerably from species to species, experts agree that the margin of safety for human beings must be based on the lowest LD_{50}—that is, on the LD_{50} for the species most sensitive to the harmful action of the chemical.

On the whole, a well-planned, well-executed, chronic study reveals the hazards of the chemical at various concentrations to the health of the species studied. An extrapolation method is now needed to equate animal test results to human toxicity.

The extrapolation cannot be made with scientific precision. The process is judgmental. The non-scientist has a right to express his opinion as to the proper "safety factor," but seldom gets the chance.

The U.S. Food and Drug Administration many years ago adopted a rule of thumb which was applied to proposed food additives. Assume that a chemical exhibits toxicity to rats at or above 1 mg/kg. What is the safe level for human beings?

FDA normally uses a safety factor of 100, so that it might consider safe for human consumption any amount below 0.01 mg/kg. Their reasoning is that a safety factor of 10 protects against individual differences in resistance within a species and another safety factor of 10 adjusts for species differences. The two safety factors are combined (by multiplication, not addition) $10 \times 10 = 100$ as the overall factor.

This rule of thumb can be varied in the light of specific knowledge or circumstances. Those who wish to sell chemicals generally want a lower safety factor; those exposed are not likely to agree. To sum up the situation, extrapolation of test results from animals to human beings is both science and art, but the jury must make a decision, and you should be part of that jury.

Testing in Glass—Quick and Dirty

Still another approach exists for a quick, rough screening of chemicals to determine which ones should be candidates for classical animal toxicity testing. These screening devices are especially designed to uncover potential carcinogens, mutagens, and teratogens. Tests are carried out in laboratory glassware in a few hours or days. Procedures are simple and inexpensive.

Bacteria are used as test organisms, relying on the universality of cell reproductive structure and function among all animal cells. Genes, which determine a cell's and ultimately an individual's inheritable traits, are made of the complex chemical DNA (deoxyribonucleic acid). DNA provides the molecular basis of heredity, from microbes to human beings.

If a chemical has the inherent capability of damaging DNA in an animal cell, the effect of the damage should be evident quickly in rapidly reproducing single-cell organisms, whereas the effect might show up only after years in a complex mammal. This reasoning is the rationale for the short-term tests which in latter years have been receiving much attention. Unfortunately, conclusions as to the validity and usefulness of the tests are highly controversial.

One of the first—certainly the most thoroughly studied—of such tests is the Ames test, developed by Dr. Bruce Ames at the University of California about 13 years ago. The Ames test utilizes a damaged bacterial strain (a mutant unable to synthesize histidine, a chemical necessary for life). The test hypothesizes that a carcinogen can alter DNA; such alteration (or mutation) can result in repair of the damaged DNA in the bacterial strain used for the test. In other words, the strain used for the test will not grow in a histidine-free environment unless a carcinogen is present.

Researchers have tested several hundred chemicals in this manner. It is claimed that nearly 90 percent of known carcinogens give a positive test; about 13 percent of compounds tested give a false positive, that is, they give a positive result even though they are thought not to be carcinogens.

The Ames test costs about $300 to $1000 per chemical tested. Some 1,000 laboratories use the test; the Ames test is used routinely as a premarket screening test by some very large chemical companies.

Tests like the Ames test admittedly have a major deficiency. Many compounds are not carcinogens until after they are converted by the enzyme system of the mammal into more reactive forms. In order to meet this objection, tests have been devised which include in the test medium enzymes which metabolize the test chemical. Results have varied significantly from laboratory to laboratory. Active research is continuing to develop tests of improved reliability and validity.

There are now at least 50 different cellular tests under study, leading to guarded optimism that a highly reliable and valid test will be developed. In the meantime, these tests can be a valuable addition to the tools available for assessing the toxicity of chemicals.

However, industry strongly opposes applying the results of both animals testing and cellular testing to human beings.

Screening

Evaluating chemicals for toxicity, whether on human beings or animals, is costly and time-consuming. Tens of thousands of chemicals are being manufactured and used in the United States. Resources—skilled personnel, laboratory facilities, money, time—are not available to test more than a small percentage of these chemicals. Methods are needed to screen out those chemicals most likely to be toxic, so that our limited resources can be focused on the greatest risks. Scientific techniques are needed to substitute for random or after-the-fact selection of those chemicals most likely to be harmful.

Every chemical compound has its unique chemical structure. Each is unique in the kind and number of atoms in its composition and how they are arranged relative to each other in space. Chemists have been able to discover and describe in chemical shorthand symbols the structure of almost all known compounds. These structures are being used to make predictions about the toxicity of the compounds.

This "structure-activity" screening has as its basic assumption that "one can make reasonable inferences about a chemical's properties by grouping it in a class with other chemicals of similar structure that have known effects." (Slesin, L. and Sandler, R., Ecology Law Quarterly, Vol. 7, No. 2, 1978, p. 372). This assumption has been used for years in the commercial development of biologically active chemicals like pesticides and drugs with some success. Experience teaches that similarity in chemical structure frequently but by no means always means a similarity in biological activity.

Compounds, then, can be screened as to the probability that they will be toxic by the structural similarity of their molecules to molecules of known toxicity.

It is difficult to use or even understand this screening procedure without chemical training. But everyone interested in toxic substances should know that "chlorinated hydrocarbons" are more likely to be toxic than a chemical picked at random, that "polynuclear aromatic hydrocarbons" should be suspected as possible carcinogens, that compounds of certain sizes and shapes are more likely to be toxic.

This screening method admittedly is crude, but it is useful, rapid and inexpensive.

What Can Happen? Cell Changes, Cancer, and Monsters

Exposure of human beings and other higher animals to toxic substances can produce injuries running the gamut from pain, nausea, and itching to chronic diseases of the heart, lungs, liver, or kidneys and to effects like paralysis, blindness, convulsions, and death.

Attention is just recently being focused on the serious but often subtle changes which can be caused by low-level exposure to some chemicals. Most serious are changes which involve the fundamental building block of the body, the cell. Three kinds of effects are well documented.

Carcinogens

Carcinogens are materials which cause cancer (carcinomas). Cancerous cells are like normal cells, but for imperfectly understood reasons, they reproduce without the constraints of normal cells. A cancer is a chain reaction. Once a single cell becomes cancerous, the cell reproduces without limit at an exponential rate (one cell becomes 2,4,8,16,32, ... 2^n), "n" being a number limited only by successful medical intervention or death of the organism.

Mutagens

Mutagens are substances which cause mutations. A mutation is a hereditable change in the genetic material in a cell. Less technically, a mutation is a change in a cell which alters one or more characteristics of the organism, the new characteristic being passed on to all of the cell's offspring and the offspring's offspring.

Mutations may occur in plants and bacteria as well as animals. Research botanists and plant pathologists can induce mutations at will in plants by exposure to certain chemicals (ethyl methanesulfonate and nitrosourea are commonly used).

Mutations, which may occur in any cell of an organism, are almost invariably harmful. (Only those that occur in reproductive cells can be passed on from one generation to another of a multicellular animal). In the rare case where a mutation better adapts the organism to its environment, evolutionary progress in the species may result. The higher up in the evolutionary scale, the more complex and specialized the organism is, the less the probability that a mutation will be desirable. In a human being, the probability is near zero.

Mutations in man and higher animals are usually so injurious that the mutant cell dies or is unable to reproduce itself. If the mutant cell survives and reproduces, undesirable effects are often severe. Commonly observed are abortion, birth defects (such as cleft palate), congenital diseases, decreased resistance to diseases, shorter life span, and mental retardation.

Some chemicals cause birth defects. Exposure to mercury produced a deformed spine in the fish pictured above. Credit: EPA DOCUMERICA - Donald Eumerich

Teratogens

The word teratogen derives from the Greek word teratos, meaning monster. A teratogen is a substance which changes the embryo as it is developing during pregnancy, causing birth defects.

The drug thalidomide is the most notorious teratogen. Thousands of pregnant women using the drug gave birth to children with defects in their limbs, so that their arms or legs resembled the flippers of a seal.

Since only pregnant women are subject to the effects of teratogens, great caution should be exercised as to the drugs taken during pregnancy. Adding to the problem is the fact that the first 3 months of pregnancy is the time of greatest danger, and women may not be aware they are pregnant during part or all of this period.

Cancer

> *"Cancer is the only major cause of death that has continued to rise since 1900. It is now second only to heart disease."*
>
> —Gus Speth, Chairman, President's Council
> on Environmental Quality

Cancer has become the second leading cause of death in the U.S. and is probably more feared than any other disease.

There is a strong link between cancer and toxic chemicals. Of the 400,000 annual deaths from cancer, it has been estimated that between 20 and 38 percent, or at least 80,000, are due to occupational exposure to carcinogens—chemicals causing cancer. In addition, people may be exposed to known and unknown carcinogens in their water supplies, their cosmetics, the fish they eat, the disposal dumps in their neighborhoods, the air they breathe.

> *"We must do a better job of trying to assess the risk. The recent discovery of angiosarcoma (a type of cancer) in vinyl chloride workers is of about the same order of magnitude as the automobile death rate .... I think such a comparison can be meaningful to the worker and the general public. Terms that have been used .... such as a 'serious new industrial disease' .... and 'tough new rules' are most misleading to everyone concerned."*
>
> —Dr. Fred Hoerger
> Dow Chemical Company

Various figures have been cited about the incidence of environmentally induced cancer, sometimes to enlighten but often to persuade. A common statement is that 80 to 90 percent of cancers are environmentally induced. Others treat this estimate as a piece of pure propaganda, and point out (correctly) that "environmentally induced" includes voluntary smoking and skin cancers from exposure to the sun. Some of the latter groups (see Dr. Hoerger's quote) draw the conclusion that cancers induced by industrial chemicals are trivial in number compared to the benefits to society from chemicals. Some assert that enlightened industry will ensure that all necessary precautions will be taken (the mice will guard the cheese factory) and the government and the citizen should "butt out."

The facts are clear. Cancer is a serious disease. A significant portion (it is non-productive to argue about the exact percentage) of cancers are induced in part or in whole by involuntary exposure to certain chemicals. It is simple self-preservation for the ordinary citizen to be aware of the problem, know the facts and issues, and help find a solution.

Cancer occurs in animals. Its incidence is increased by some chemicals—applied to the skin, ingested, breathed, or injected. Every chemical, with one possible exception (trivalent arsenic), which induces cancer in human beings induces cancer in animals.

While it does not necessarily follow that every chemical which causes cancer in animals also causes cancer in human beings, we put ourselves unnecessarily at risk by assuming the opposite. Government agencies agree. Most competent scientists agree. The very same people who assert that just because a chemical gives cancer to a rat does not prove that the chemical causes cancer in man will conveniently overlook the converse, that just because a chemical does not give cancer to a rat does not prove that the chemical is not a carcinogen to man. It should be assumed that a chemical which induces cancer (many scientists will include non-malignant tumors) in an animal must be treated as a human carcinogen.

There is another myth which is used to obstruct appropriate safeguarding of the public's health. According to this story, just about everything causes cancer in laboratory tests. Those poor rats are loaded with so much of the chemical that they can't help but get cancer. Sure, maybe a few of us would get cancer if we drank 1,500 bottles a day of soda pop containing saccharin or ate nothing but pesticide-sprayed cranberries all our lives. So let's not heed these cancer-of-the-week scare stories, the argument concludes.

The facts are quite different. About 7,000 chemicals have been tested with animals for cancer effects. All but about 500 came out with a clean bill of health. Of the 7,000, 93 percent did not cause cancer in animals.

Litton Industries' Bionetics Laboratories did chronic mouse feeding studies using massive doses of 120 pesticides, fungicides, and herbicides. From the chemical structure and physiological activity of these chemicals, a high percentage could be expected to be cancer causers. Yet, only 11 produced a statistically significant greater number of tumors than the controls. Almost 90 percent of the expected bad ac-

Those that cause cancer get a lot of publicity; those that don't get none. In a nutshell, that is why it is so easy to get the impression everything tested is found guilty.

But, you may ask, why go to massive doses of the chemical in feeding experiments? Part of the answer (see pp. 47-49) applies to testing all chemicals, not just carcinogens.

There is another reason, unique to carcinogens, mutagens, and possibly teratogens. Toxic chemicals, in general, can be characterized by their threshold values, by no-effect dose levels. Exposures to traces of a chemical less than its threshold amount present no risk of harmful effect. Threshold values can be established for individuals, varying within a population, as well as for the entire defined population.

It is not possible to establish no-effect levels for carcinogens. While this statement has been and continues to be bitterly disputed by some scientists, the ovewhelming majority of informed specialists and expert committees agree that, unlike other kinds of toxic substances, there is no such thing as a safe level for a carcinogen. This conclusion is also the position of the U.S. government.

This uniqueness is well-documented by research. The uniqueness of carcinogens appears to arise from the underlying biological nature of cancer. The prestigious World Health Organization cites the following causative factors:

(1) the self-replicating nature of the cancer cell;

(2) summations of irreversible effects in the mechanism of cancer formation;

(3) evidence from experiments on initiating cancer by contact exposure which indicate a lasting effect from a single tumor-initiating event;

(4) the fact that cancer can occur in response to chemicals, even after single doses, long after the chemicals disappear from the body;

(5) cancer may result from mutation of a single cell.

The fact that it is not possible to set no-effect levels for carcinogens is part of the rationale of the Delaney Amendment to the Food, Drug, and Cosmetic Act, which prohibits putting into food any amount, no matter how small, of a chemical additive which has been shown to be a carcinogen to man or animal. For all other kinds of toxic additives, "safe" levels may be added.

What all this means is that *no* level of exposure to a carcinogen is toxicologically insignificant for a human being. We must quickly add that, as a practical matter, while even the slightest exposure to a carcinogen imposes a risk, the *extent* of the risk *does* increase as the level or length of exposure increaes.

So, concepts like "unreasonable risk" are permissible and valid as applied to carcinogens. Thus, EPA may decide that, for a given chemical, the possibility that 10, or 100, or 1,000 cancer deaths a year is an acceptable risk, and regulate the production or use of the chemical accordingly.

The net effect is that the furor over whether there is or is not a no-effect level for carcinogens has no practical effect on carcinogens except for food additives.

The evidence that establishes carcinogenicity to human beings may seem, in many cases, highly uncertain to those who specialize in scientific experimentation. But this evidence is all the evidence that exists. All too often, it seems to the authors, the people who object to regulation based on incomplete evidence are the same people who profit from chemicals which have received insufficient testing. These same people also object strenuously to the neccessity (cost) of more complete testing.

Chapter IV Summary

Environmental Exposure: The Chance of Harm

If a mine, farm, or factory uses or makes a toxic substance, that workplace poses a potential danger. If employer and employee are aware of the danger, and if proper precautions are taken, the danger can be minimized. But the employer weighs these precautionary measures against their costs, so we cannot rely solely upon voluntary action of employers.

Toxics may be inhaled during the manufacturing process, or may escape the workplace through smoke.

Industrial plants may get rid of their wastes by discharging them into streams, or by shipping them to a waste disposal site; when toxic substances are present in the waste, surface water can be contaminated. By law, no discharge into navigable waters may be made without a permit. Plants use various levels of treatment on wastewater. But both technical knowledge of adequate treatment and enforcement of regulations is inadequate.

FDA does a good job of keeping suspect additives (at least those intentionally added) out of food. Twenty years ago there was an outcry that FDA activity under the Delaney amendment would stifle research, stop the flow of new improved food products, drive up food costs, and put small food companies out of business. But these things haven't happened. We now hear the same kinds of arguments against measures designed to protect environmental health. Business interests prevented passage of a provision in the Toxic Substances Control Act which would have required mandatory pre-market testing of new chemicals for safety before production would be allowed.

CHAPTER IV

Environmental Exposure: The Chance of Harm

Are Toxic Substances Risky?

Earlier we described the concept of risk, noting that two factors, toxicity and exposure, are involved. Unless it comes into contact with a living thing, even the most toxic substance in the world cannot cause direct harm to living things.

Toxicity and its evaluation have been discussed in some detail. Since a chemical will not injure unless it has both the *ability* and *chance* to injure, we must also examine the exposure, or chance, facet of risk. How much of the chemical gets into the environment, how long does it remain there, what living organisms are exposed, at what levels and for how long? The answers to these and similar questions are far from simple.

How Much Escapes?

In judging how much of a chemical enters the environment, one benchmark is how much of the chemical is produced. Other things being equal, the greater the production volume, the more can get into the environment. A million-ton-a-year product is more suspect than a pound-a-year product.

But "other things" are seldom equal. The amount of a chemical that gets into the environment may range from none to 100 percent of the amount manufactured. How much escapes depends on many factors. Escape occurs through complex and interrelated paths. Preventing escape in one way may—or may not—cause escape in another.

How Is It Used?

One factor in how much of a produced chemical gets into the environment is the use to which the chemical is put.

Chemicals may be designed for complete and purposeful entry into the environment. Water treatment chemicals and agricultural chemicals—such as fumigants, pesticides, and fertilizers—are put directly into the air, land, or water.

At the other end of the spectrum is the chemical made entirely in closed reaction vessels and used by the manufacturing company in a closed system. The prospect of escape of such a chemical into the environment, barring an accident, approaches zero.

In most instances, the end use gives a clue as to who and how many are exposed. The chemical may enter a household in a cleaning product, as photographic film, in aerosol cans, in automobile antifreeze, in paint, in food can linings, as food additives—each use tells a different story. But qualitative conclusions are much easier to draw than quantitative ones.

What Path Does It Take?

It is as difficult to keep a chemical out of the environment as to keep a convict in prison. The chemical has an almost endless number of escape routes. These can generally be classified as escape into the land, the water, or the air—although transfer from one medium to another is often a factor.

Such classification is often useful, and our regulatory approaches have often been patterned accordingly. Air pollution, water pollution, ocean dumping, hazardous landfills, nicely fit the categories.

Agricultural chemicals may be sprayed into the air, be put in irrigation water or applied directly on the land or plant. Combustion processes result in air pollution from oxides of nitrogen, fly ash, or polynuclear aromatic hydrocarbons. Production wastes and by-products may be put into wastewater effluent or land disposal sites or dumped into the ocean.

To complicate the picture, what escapes in one medium may end up in another. Toxic chemicals in landfills may be leached out and enter a river. Particulates in the air may settle onto the ground. Toxic chemicals in wastewater may end up in fish eaten as food. The environment is complex and dynamic. Its capacity to transport and transform should not be underestimated. This capacity further complicates knowing the kinds and amounts of toxic chemicals present.

What Becomes of It?

Once a chemical escapes into the environment, it is subject to transport and to change. The winds and the streams may carry it far from its point of entry. It may enter the bodies of migratory fish or wildfowl and remain in its original chemical form or be metabolized; the animal or the human being eating the animal may suffer injury.

The chemical may undergo physical change. Particles in the air may be dissolved in rain and end up in surface water. Substances in the water may evaporate, entering the atmosphere as gases.

Chemicals entering the environment may undergo chemical changes which convert them to different chemicals, thus altering their toxic effects. Toxic substances may be converted to relatively harmless substances or to toxic by-products.

How Much Exposure?

The preceding description of the paths by which chemicals can enter the environment and then be transported and transformed will give some insight into the difficulty of assessing the exposure experienced from a chemical.

There is the difficulty of estimating the total amount escaping into the environment during manufacture, use, or disposal.

Total amount by itself is not meaningful. Further difficulties arise in determining where the chemical goes, in what concentrations, in what physical form, how long it stays in the environment, and where and in what form it ends up. These facts are needed not as an academic exercise but as a practical guide to learning the extent to which living organisms are exposed to the toxic chemicals.

Getting a handle on environmental distribution of a toxic chemical can be even more challenging than evaluating its toxicity. Yet the facts are just as necessary to estimate risk. Let us discuss exposure factors more fully, to help us arrive at answers, to decide who is put at risk and how.

Danger Spots

In this section we will focus on the ways toxic chemicals get into the environment.

The Workplace: Factory, Farm, and Mine

The workplace is the origin of many toxic substances. Exposure occurs either at the workplace itself—occupational exposure—or elsewhere.

Occupational exposure can arise whenever the substances being processed or manufactured come into contact with a worker's skin or clothes, the air he breathes, the water he drinks at the plant, or the lunch he eats. The Kepone disaster is an example of what can happen. The cancers suffered by many workers in workplaces using or producing vinyl chloride or asbestos are further examples.

If a mine, farm, or factory uses or makes a toxic substance, that workplace poses a potential danger. If the employer and the employee are aware of the danger and if proper precautions are taken, the danger can be minimized. The situation is far from perfect, as evident from government estimates of occupationally-caused sickness and deaths. While it is true that most businesses take steps to prevent exposure to toxic chemicals, it is also true that those steps are carefully weighed against their costs. Employer and employee interests may conflict substantially, the employee being interested first in his health and second in his paycheck, the employer first in his profits and second in the health of his employees. One can believe completely in the positive benefits of free enterprise and the profit incentive, yet be alert to the dangers inherent in relying solely upon the voluntary action of employers.

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The workplace is the origin of many toxic substances. If employer and employee are aware of the danger and if proper precautions are taken, the danger can be minimized. But the employer weighs these precautionary measures against their costs so that we cannot rely solely upon the voluntary action of employers. Credit: EPA

Beyond the Plant, Into the Air

Toxic substances may escape the confines of a plant by air. Chemicals may be carried long distances as dust particles. Volatile compounds—gases and substances with low boiling points—may become part of the atmosphere. Toxic substances may arise from combustion processes in the plant and be emitted via smokestacks.

Notorious is the danger from toxics arising from combustion of fossil fuels in utility power plants. These substances, notably lead, cadmium, selenium, and polynuclear aromatic hydrocarbons attach themselves to fine particles which are carried long distances, not dissipating as a gas would. The human body has no built-in respiratory defense mechanism against entry of such particles, as it does against larger particles.

Asbestos, beryllium, mercury, and vinyl chloride are additional well-known toxic substances which may pollute the air.

Toxic substances may enter the atmosphere directly from the industrial source, and during use of a manufactured product. For example, toxic volatile substances such as trichlorethylene may escape from a dry-cleaning plant using solvents shipped to it by a chemical manufacturer. Toxic materials may be sprayed from an aerosol container used by a hobbyist. Or they may escape by accident during transport of a toxic substance by truck or rail.

Into the Water: Indusrial Wastewater

Most manufacturing and processing plants get rid of their wastes either by discharging them into nearby streams or rivers or by shipping them to a water disposal site. When toxic substances are present in the waste, both methods can contaminate surface water; disposal sites, in addition, endanger groundwater through seepage.

The threat to health and environment from watewater comes from (1) the large volume of such waste, and (2) the fact that such wastewater, in total, may contain significant amounts of every chemical made or used by man. In their waste streams, industrial plants may be churning out, not only some of their products, but also their raw materials and by-products. Large chemical companies may have hundreds, even thousands, of compounds in their discharge.

Where does the wastewater go? Into sewer systems, into roadside ditches, onto the ground, into ponds, streams, lakes, rivers, estuaries, bays, oceans. By law, no discharge into "navigable waters" can be made without a permit. In theory, this permit sets safe standards which the discharge must meet.

Because of the importance of this source of risk, a major section of this handbook studies wastewater discharges and the permit system, using the State of New Jersey as an illustrative example. How the permit system works in practice is examined in some detail in that section.

Most industrial wastewater receives some type of treatment. Some plants treat effluents directly and then discharge to a convenient stream. Others pipe the untreated effluent to municipal sewage treatment plants. Yet others "pretreat" their wastewater, before piping it to a municipal plant. Lastly, some plants provide no treatment at all and simply pump wastes into the waterways.

The difficulty is that almost none of the treatment is designed to remove specific compounds. Permit limits are set for only a very few toxic chemicals (primarily metals and pesticides). Present treatment systems remove known percentages of the total amount of pollutants, but, for any specific pollutant, percent removal is not known and may range from 0 to 100.

As public awareness of the danger from toxic substances has increased, more attention has been directed to the problem. In August, 1979, in announcing a relaxation of regulations of non-toxic water pollutants, EPA stated that "tough" controls are still "required in treating toxic pollutants that threaten public health." The Clean Water Act of 1977 specifically addresses the subject of toxics in water, and EPA is grappling with implementation of the goal of limited discharge of toxic chemicals. Attention is presently confined to the 129 priority toxic pollutants.

This aerial view shows the discharge of taconite tailings into Lake Superior that contaminated the water supply of thousands. Most manufacturing and processing plants get rid of their wastes either by discharging them into a nearby body of water or by shipping them to a disposal site.
Credit: EPA DOCUMERICA - Fred Ward

The technology necessary to define and solve the problem is far from sufficient, principally because until very recently little was being done to acquire the necessary information and know-how. With prodding from an informed citizenry, the situation may improve.

Presently, our rivers, streams, ponds, and lakes are receiving effluents with unknown toxic substances in unknown amounts. There is every reason to believe that both the number and amount of these toxics is large.

Water is an efficient carrier for suspended and dissolved gases, liquids, and solids. Whatever enters a receiving water may be carried far afield, from creek to stream to river to pond or lake or ocean. Along the way, there can be and has been environmental havoc. Shellfish die. Fish store toxic chemicals and are eaten by people. Rivers become unfit for swimming. Drinking water is contaminated. To restore the quality of our water, control of toxic substances is at least as necessary as control of Biochemical Oxygen Demand (BOD) and Suspended Solids. (BOD is a measure of the oxygen required to break down the material in the wastewater, and suspended solids is the amount of undissolved material in the wastewater.)

Into the Land. Out of Sight, Out of Mind.

The generation of waste material of every description is inherent in industrial manufacturing and processing operations. Amounts of waste are enormous. The Council on Environmental Quality, in 1976, stated that solid waste (130 million metric tons) generated in the U.S. was sufficient to fill the New Orleans Superdome from floor to ceiling twice a day, 365 days a year. Every year the amount increases. The projection for 1985 is 180 million metric tons.

EPA calculated that 30 to 40 million metric tons of these wastes are hazardous, and that 80 to 90 percent of such wastes are presently being disposed of in an unsatisfactory manner. It is estimated that 50 percent of hazardous waste is disposed of by lagooning in unlined surface impoundments, 30 percent in nonsecure landfills, and 10 percent by dumping into sewers, spreading on roads, injecting into wells, or by uncontrolled incineration.

Realizing that hazardous waste disposal is a major problem is so recent that the full extent of the problem is barely known. An EPA contractor, using limited data (on 103 sites), estimates there are 32,000 waste disposal sites, of which 638 contain significant quantities of hazardous materials. On June 1, 1979, EPA published data on 151 hazardous waste sites it had under investigation. This list, arranged geographically, is obtainable from: Kate Bouve, A-107, Office of Public Awareness, Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460. One can argue about numbers, but there can be no arguing the fact that the problem is serious and widespread.

Wastes can be hazardous for a number of reasons. Chemicals in the waste may be, for example, corrosive, inflammable, explosive, or toxic. These manufacturing leftovers are often disposed of by burial in the ground at the plant site or at a site to which they have been hauled.

The Love Canal incident is one example of what can happen after such burial. Love Canal is no isolated incident.

Danger arises because land wastes can and do find their way into ground and surface waters. If the disposal of toxic wastes is secure, that is, if the waste material remains unchanged precisely where it was stored or buried, no environmental damage results. The problem is not that toxic wastes are dumped or buried but rather that burial or landfill sites are all too often improperly designed and maintained. With the passage of time, water—coming in contact with improperly stored wastes—extracts or leaches out part of the waste and carries it away. Such transport out of the site can be effected both by the action of groundwater and by runoff from surface water. The effect is the same: contamination by toxic substances of wells, streams, ponds, rivers, groundwater. People, animals, and plantlife all suffer.

Government agencies, from EPA on down to state and local governments, are grappling with this problem. Many people feel that the action of government, for a variety of reasons, is too little and too late.

Individual citizens can help both by locating sources of potential trouble and by persuading someone—the company involved, the local health department or other municipal official, the state environmental protection or health department, or the nearest Regional Office of EPA—to do something to correct the situation.

A group known as "Environmental Action" has organized a "Hunt the Dump" project and is compiling a master list of all dump sites throughout the country. They would like to receive information from you and to answer your questions. Their address is: Environmental Action, Suite 731, 1346 Connecticut Ave., N.W., Washington, D.C. 20036.

Into the Home

Manufactured chemicals often leave a factory for ultimate use by a consumer. Textiles have chemical finishes, plastics are chemicals containing chemical plasticizers, paints are chemical mixtures.

The list of ingredients on almost any commercial food label is evidence of the widespread practice of adding chemicals (food additives) to foods and beverages.

The U.S. food supply is probably the safest in the world. Risk from toxic substances intentionally added to foods is minimal (although environmental contaminants cannot be excluded as readily). The reason is not hard to find.

The Federal Food, Drug, and Cosmetic Act of 1938 controls what can be added to foods. This Act was amended in 1958, making it necessary to submit safety data on new proposed food additives, along with information on the amount to be added to foods and consumption patterns of those foods. Only if the Food and Drug Administration (FDA) is satisfied that the proposed addition is safe does it grant permission to use the additive. FDA's standards for proof of safety are high.

As a consequence of this "guilty 'til proven innocent" approach, plus the Delaney amendment referred to previously which prohibits addition of even a trace of a carcinogen to food, risk to health from intentional food additives is slight.

Two points from this country's experience with FDA are of special relevance to the general problem of toxic substances.

(1) There were loud cries from business interests and some academic circles that the 1958 amendment would stifle research, stop the flow of new, improved food products, drive up food costs, and put small food companies out of business. Twenty years later there is no evidence that any of this doomsaying was prophetic. We are now hearing the very same kinds of arguments with respect to each new environmental health issue.

(2) Business interests prevented the passage of a similar provision in TSCA, which would have made it mandatory that new chemicals be proved safe by appropriate testing before production would be allowed. Lack of this provision is a serious weakness in TSCA.

Chapter V Summary

The Social Dilemma

Two societal needs may be in conflict: a long, healthy life in a clean environment; the material benefits of technology.

Business is expert in communicating its needs to government and in influencing government decisions. By contrast, the individual suffers from a lack of information, organization, and financial resources.

Specialists—scientific, technological, legal, social, and economic—may give conflicting advice. Citizens can use these specialists as consultants, then make their own decisions.

Some companies do act responsibly to prevent toxic damage. An example is a small New Jersey manufacturer of flame retardant chemicals which is altering its operation so as to (1) reuse toxic substances where possible rather than send them out into the environment, (2) substantially reduce the amount going into the environment, and (3) dispose of the rest in a relatively safe manner. As a result, the products—though toxic—cause little risk once their presence in the environment is kept to a minimum.

This example demonstrates how industry can spend money to eliminate a problem rather than use the money trying to convince the public, regulatory officials, and the courts that they should continue doing what they are doing.

CHAPTER V

The Social Dilemma

> *"I know of no safe depository of the ultimate powers of the country but the people themselves; and if we think them not subjective enough to exercise their control with a wholesome discretion, the remedy is not to take it from them but to inform their discretion."*
>
> —Thomas Jefferson

Can Mere Citizens Make Important Decisions?

The problem of toxics is not simple. Few actions concerning toxics are clearly right or clearly wrong.

The government serves the needs of the people. Our institutions, our laws, our regulations, in the final analysis are an expression of our needs and wants. Environmental laws and regulations address two partially conflicting societal needs: a long, healthy life in a clean environment, and the material benefits of technology. These basic goals are not mutually exclusive, but they require careful balancing to result in the most good for the most people.

One well-known company proudly tells us that progress is their most important product. Is an intelligent citizen to be more concerned with progress or with safety? Or where in between extremes? Americans are always quick to use and enjoy material things; we are less quick to ask ourselves whether we really need all the products of technological advance, and whether these endless new products contribute to the quality of life, or in fact detract from it.

The needs and wants of business are focused almost entirely on economic benefits *to the business;* after all, the goal of business is to make a profit. But the citizen is concerned not only with a high material standard of living—which is well served by business—but also with the quality and length of life, a goal of relatively secondary significance to business.

Business is expert in communicating its needs to government and in influencing government decisions. The individual is not nearly so expert—suffering from a relative lack of information, organization, and financial resources.

Individuals, alone or in citizen groups, can protect their interests only by arming themselves with the facts and by understanding the decision-making process, the institutions involved, and how they can effectively communicate with and influence those institutions.

One thing citizens are up against in the conflict with business is the willingness of some businesses to bend the truth, or to tell half-truths, in order to present a convincing case.

It is disturbing to observe a large chemical company spending a great deal of money informing the public that "life is impossible without chemicals." The statement is true, but so is the statement "chemicals kill." Both are simplistic and serve more to cloud the issue than to solve the problem of safe use of beneficial but potentially toxic chemicals.

What are "the facts"? Well, which facts?

What is "the cost" of using or not using a specific toxic chemical? Well, the cost to whom? Or, the cost in dollars or in something else? Or, the cost today, or tomorrow, or for a lifetime?

And yet, we cannot debate endlessly. Citizens need to make decisions.

It makes sense for concerned citizens to seek help from specialists. But the specialist will get you if you don't watch out, because for any given situation concerning toxics, there are many kinds of specialists. Scientific, technological, legal, social, and economic specialists all could be considered experts. And so they are in their own fields. Yet, often these experts give conflicting advice. Citizens cannot be intimidated by the experts, nor can they abdicate their responsibility to make decisions. In the end, citizens have to listen to the specialists—the technicians—and then use common sense to make their decisions even in the face of uncertainty.

Are All Chemical Companies Villains?

Just as the Kepone and Love Canal stories demonstrate tragic irresponsibility, other examples exist of companies acting responsibly to prevent future toxic damage. One of these is Saytech.

Presently our rivers, streams, ponds and lakes are receiving effluents with unknown toxic substances in un-known amounts. What makes toxic pollutants so dangerous is that they often cannot be seen, smelled, or tasted.
Credit: Grant Heilman

Saytech is a relatively small chemical manufacturing company (80 employees) producing only one product line: brominated flame retardant chemicals for the plastics industry. These retardants are incorporated into plastics to reduce the rate at which they burn. Saytech currently manufactures the following chemicals:

decabromodiphenyl oxide,
pentabromoethylbenzene,
dibromoethyldibromocyclohexane,
and plans to produce
tetrabromophthalic anhydride

Saytech's manufacturing operations are conducted near Sayreville, N.J. The community has no storm sewers near the plant, relying on road ditches. Until recently, any solids or liquids deposited on the ground from Saytech's operations could be carried via rainwater into these ditches and into groundwater. In a consent decree arising from action by the Department of Environmental Protection of the State of New Jersey against Saytech, the company agreed to build a retention basin. Saytech has now paved all surfaces around the plant so that runoff is collected and sent to the completed retention basin. Contents of the retention basin plus process water—water used in the manufacturing process—are then sent to the Sayreville municipal sewer system. Sayreville sends all its wastewater to the publicly owned Middlesex County Sewerage Authority (MCSA) for treatment. In the event that rains are unusually heavy, Saytech has an NPDES permit to dispose of overflow into the Raritan River.

On February 16, 1979, ethylene dichloride, one of the chemicals used in Saytech's manufacturing process, was designated by EPA as a hazardous substance under the Clean Water Act. It is also on EPA's list of priority pollutants. According to a Saytech spokesperson, ethylene dichloride is now present in Saytech's wastewater stream.

The following considerations leave no doubt that Saytech operations should receive high priority as to *potential* risk.

On November 26, 1978, the Interagency Regulatory Liaison Group (IRLG)—composed of members from the Environmental Protection Agency, the Food and Drug Administration, the Occupational Safety and Health Administration, and the Consumer Product Safety Commission targeted for control 24 toxic pollutants, among which were polybrominated biphenyls (PBB's). Decabromodiphenyl oxide (DBDPO), made by Saytech, is a very close chemical relative and contains as an impurity a small quantity of decabromodiphenyl, which *is* a PBB. Studies by the Dow Chemical Company indicate that DBDPO, unlike PBB, is readily broken down (degraded) by ultraviolet rays, so any risk should be less persistent than that from PBB.

In July, 1977, IRLG published a preliminary list of 300 substances for further evaluation as to risk "to humans and the environment." On that list were decabromodiphenyl, decabromodiphenyl ether (another very close chemical relative to decabromodiphenyl oxide), and tetrabromophthalic anhydride (another one of Saytech's products).

Saytech's NPDES permit requires that Saytech's effluent be sampled and analyzed for polybrominated biphenyls (PBB's) and polybrominated diphenyl oxide and that the concentration of PBB's shall not exceed 0.001 mg/ l (0.1 ppb). These requirements apply only to overflow from Saytech's retention basin, which was designed to contain runoff completely except in the case where a storm exceeds that of the once-in-25-years maximum storm.

In other words, except for the rarest of circumstances, Saytech's wastewater, toxics and all, goes to MCSA's treatment plant. That treatment plant is not designed to remove such toxic substances. We shall discuss this fact elsewhere.

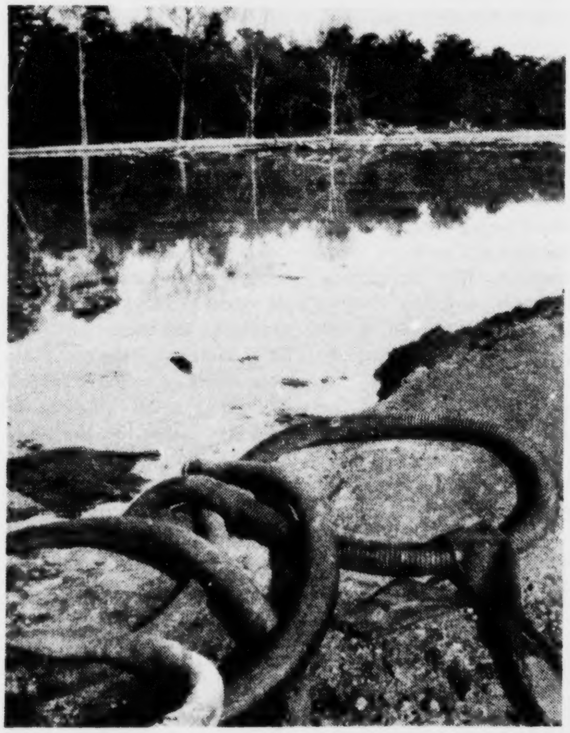
The management of Sayech consented to meet with us to discuss these problems. In our discussion, Saytech described the problems as they used to be and as they are now, along with their plans for the future.

As a result of a $211,000 study plan, Saytech has decided upon and is now assembling a three-stage pretreatment system to remove toxic chemicals. As a side benefit, Saytech expects to recover saleable chemical products from the treatment.

1. Wastewater is filtered to remove suspended solids (solid materials that are not dissolved but are so finely divided that they do not settle to the bottom of the water).

2. Wastewater is processed through a "splitter tank," which, acting like a chemist's separatory funnel, separates the water from organic solvents in the water. The solvents, including the hazardous ethylene dichloride, are distilled and reused. Residue from the distillation is disposed of as hazardous waste.

3. Wastewater is passed through "activated carbon." Activated carbon is charcoal which has been processed so that it consists of particles with a very large amount of absorbent surface, capable of attracting and retaining a wide variety of compounds. The activated carbon removes solvent still remaining in the water plus organic compounds. Experiments demonstrated, according to Saytech, that 87 to 99 percent of the brominated organic compounds (the toxics of concern) are removed by the carbon treatment.



Inadequate management of hazardous waste led to a boy's death at this open waste pit. Citizens must protect their interests by arming themselves with the facts, understanding the decision-making process and effectively influencing the institutions involved. Credit: EPA Journal

Periodically, the used carbon is treated with live steam, removing volatile solvents, which are reused. The remaining carbon, on which the removed organic compounds are adsorbed, is disposed of as hazardous waste. Fresh activated carbon is used for continued operation of the removal process.

Saytech employs a contractor to remove and dispose of its hazardous waste. Their spokesperson stated that Saytech is very careful to select a reputable contractor.

Saytech's treatment system is scheduled for completion by the end of 1979, at an estimated cost of over $200,000.

The evaluation of Saytech's toxic substances problems may be described briefly: While they do not produce a large amount of toxic substances, those they do produce are mostly highly toxic at low levels and may persist, once in the environment. There are similarities, so far as products manufactured, to the Hopewell, Va., plant which made Kepone.

Fortunately, there are also striking dissimilarities to the Kepone plant. Saytech's products do not enter the air around the plant. Entry of toxic products into groundwater has been stopped by the recent construction and use of a retention basin. Saytech disposes of its wastewater legally through a municipal treatment plant. Since this treatment plant (MCSA) sends its effluent into Raritan Bay, Saytech's effluent poses no threat to the area around Sayreville. (The threat is merely passed on to Raritan Bay; this role of MCSA will be discussed in another section.) Finally, Saytech will shortly be pretreating its wastewater so that only a few percent of the present level of toxic substances will continue to flow to MCSA.

In summary, Saytech is a small company producing potentially hazardous substances. Based on information given us by Saytech, that company has recently acted in an environmentally responsible manner, altering its operation so as to (1) reuse toxic substances where possible rather than send them out into the environment; (2) substantially reduce the amount going into the environment; and (3) dispose of the rest in a relatively safe manner.

Saytech is an example of how industry can spend money to eliminate a problem rather than use the money trying to convince the public, regulatory officials, and finally the courts that they can continue doing what they are doing. Its operations also illustrate the difference between toxicity and risk. Saytech's products may be toxic, but they won't cause a risk if they are kept out of the environment.

Saytech management is not content with its present system of wastewater management and disposal. It foresees the day when the problem of toxic substance removal cannot be passed on to MCSA. Limitations on the kinds and amounts of toxics which will be accepted by MCSA may be imposed at any time. Saytech wants to be prepared.

Chapter VI Summary

What Are The Feds Doing About It?

There are at least 18 major Federal laws concerned with regulating the manufacture, distribution, use, discharge, and disposal of toxic and hazardous materials. The laws safeguard waterways and water supplies, protect a particular environmental medium, safeguard consumers, regulate transportation of dangerous materials, and protect workers.

Though these laws are administered by a variety of agencies, there are some consolidated toxics-related efforts.

There is often a serious lag between a law's passage and its full implementation. It is difficult and time-consuming to develop standards and regulations which are (a) stringent enough to safeguard people and the environment, and (b) sufficiently well-ground legally and scientifically to stand up in court. When process and treatment changes are required of industry, they take time and money to make. Government enforcement and monitoring capabilities, too, take time and money to establish.

Citizens can influence the Federal situation in many ways:

1. Call toxics problems to the attention of agency officials.
2. Through elected representatives and other public officials, push for prosecution of toxic laws violators.
3. Serve on advisory committees to plan for environmental concerns.
4. Comment on draft environmental impact statements, proposed regulations, and proposed permits.
5. Ask for, attend, and testify at public hearings.
6. Initiate citizen petitions.
7. Influence legislation.
8. Go to court. As a last resort, bring citizen suits against federal agencies for non-enforcement, or against companies to get injunctions or damages (including class action suits).

The chapter tells how to use the Federal Register, the Freedom of Information Act, and the Congressional legislative process (with a listing of those Congressional committees concerned with toxic substances issues).

CHAPTER VI

What Are The Feds Doing About It?

What Are the Laws

There are at least 18 major Federal laws directly concerned with regulating the manufacture, distribution, use, and environmental discharge and disposal of toxic and hazardous materials. A synopsis of the most pertinent provisions of these statues can be found in Appendix VI-1. The interrelationships of some of these laws are shown in Figure 6-1.

What are these laws and what do they do? *Safeguard waterways and water supplies*—the Clean Water Act of 1977; the Safe Drinking Water Act of 1974; the Marine Protection, Research, and Sanctuaries Act of 1972; and the Ports and Waterways Safety Act of 1972.

Protect a particular environmental medium—the Clean Air Act, designed to safeguard the air environment.

Safeguard consumers against the use or consumption of unsafe materials—the Food, Drug, and Cosmetic Act (aimed at keeping food and drugs safe and wholesome); the Poison Prevention Packaging Act (regulating the packaging of household substances which may be hazardous to children); the Federal Hazardous Substances Act (regulating the commercial distribution and labeling of hazardous household substances and articles accessible to children); and the Consumer Product Safety Act (regulating the design, construction, packaging, and labeling of hazardous consumer products).

Regulate intrinsically dangerous materials—examples are the Federal Environmental Pesticide Control Act (prohibiting the sale, distribution, or use of pesticides unless registered and used in accordance with label instructions) and the Atomic Energy Act (regulating the processing, utilization, and distribution of radioactive materials.)

Regulate: the commercial carriage, on land, sea, or air of hazardous and dangerous materials (e.g., the Hazardous Materials Transportation Act); the manufacture and distribution of *new toxic chemicals* (the Toxic Substances Control Act); and the generation, transportation, storage, and land disposal of *hazardous solid wastes* (the Resource Conservation and Recovery Act) (see Fig. 6-2).

Protect workers against on-the-job injury associated with occupational exposure to toxic and hazardous materials—the Occupational Safety and Health Act of 1970.

How Do They Fit Together?

Why do we need so many separate Federal laws to regulate toxic and hazardous materials? Couldn't one overall law be designed to address the whole problem comprehensively, in all its aspects?

These are good questions. The answer probably is that a comprehensive approach to the control of toxic substances would be highly desirable. Practically and politically speaking, however, there is little realistic prospect of consolidating the diverse programs. Such an effort would be a monumental undertaking because there are so many statutes which approach related problems in different ways and because responsibility for hazardous substance regulation is now split among so many different administrative departments, agencies, commissions, and bureaus (each of them anxious to maintain and expand their base of power). Any effort to consolidate the multiplicity of toxic substance laws would inevitably necessitate a massive reorganization and consolidation of the different implementing agencies as well.

Such a major realignment of the legal responsibilities of so many powerful agencies would be exceedingly difficult. To provide some examples of the agencies involved, the Department of Transportatin (U.S. Coast Guard) administers the Hazardous Materials Transportation Act and the Port and Waterways Safety Act, while the Department of Labor (Occupational Safety and Health Administration) carries out the Occupational Safety and Health Act. The Environmental Protection Agency (EPA) is responsible for the seven pollution-oriented statutes, and the Department of Health, Education, and Welfare (Food, and Drug Administration) administers the Food, Drug, and Cosmetic Act. The Nuclear Regulatory Commission, the Department of Commerce, the Department of Defense, and others are also directly involved in implementing Federal laws regulating toxic substances.

Listing separately the relevant bureaus, administrations, and commissions within the major departments referred to above would result in a much longer list.

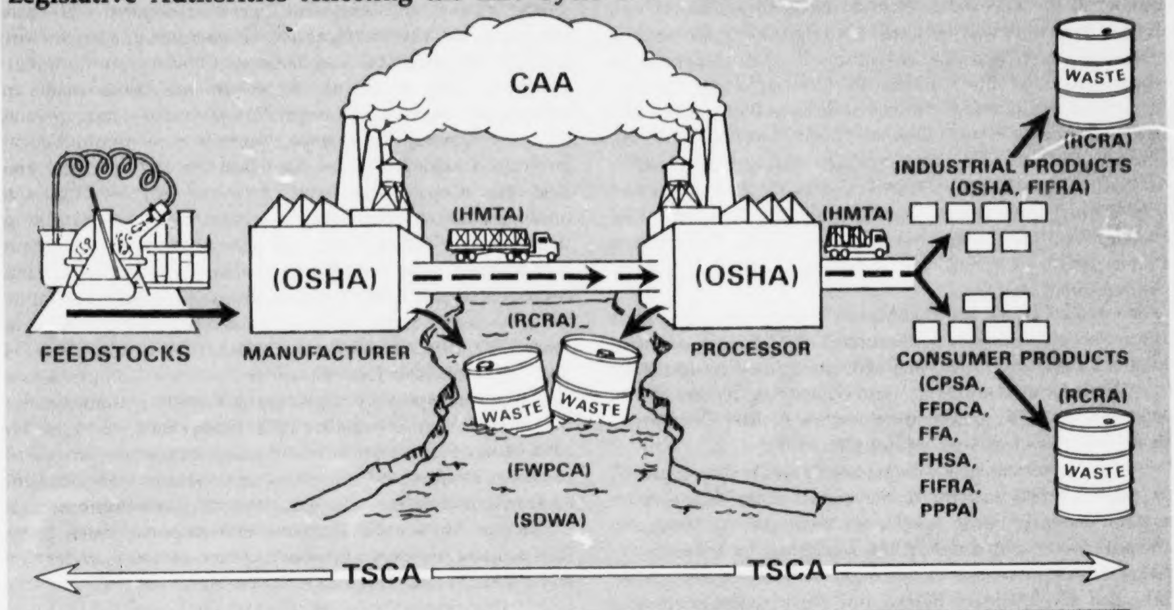
Interagency working groups in the toxics area have recently been formed to consolidate and coordinate regulatory functions within agencies. An example of this consolidation would be that a given toxic waste generator no longer has to apply separately under a handful of separate statutes for permits to dispose of hazardous wastes in different ways (e.g., with some being landfilled, some being treated and discharged into a waterway, and some being incinerated and discharged into the air).

Interagency coordination and consultation is an explicit objective of the Toxic Substances Control Act ("TSCA"). For example, section 9(d) of the Act directs the EPA Administrator, in administering TSCA, to consult and coordinate with the Secretary of Health, Education, and Welfare and the heads of any other appropriate Federal agency or instrumentality "for the purpose of achieving the maximum enforcement of [TSCA] while imposing the least burdens of duplicative requirements on those subject to the Act . . . ." Section 9(b), similarly, requires the Administrator to coordinate his actions under TSCA with actions taken under the other laws he administers.

Section 9(a) of TSCA, moreover, makes affirmative use of interagency coordination in an approach that some regard as one of TSCA's most important provisions. It authorizes the Administrator to request other agencies to take action under other Federal laws when the Administrator reasonably concludes that (1) the manufacture, processing, distribution, use, or disposal of a chemical presents or will present an unreasonable risk of injury to health or the environment, and (2) such risk may be sufficiently prevented or reduced by action taken under these other legal authorities.

Figure 6-1

Legislative Authorities Affecting the Life Cycle of a Chemical

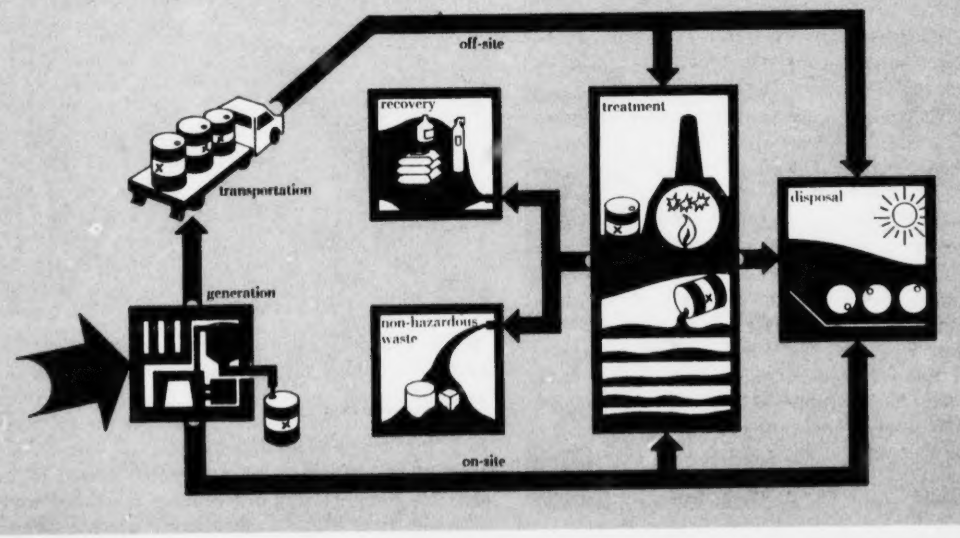

CAA
(HMTA)
(HMTA)
(OSHA)
(OSHA)
FEEDSTOCKS
MANUFACTURER
(RCRA)
WASTE
WASTE
(FWPCA)
(SDWA)
PROCESSOR
WASTE
(RCRA)
INDUSTRIAL PRODUCTS
(OSHA, FIFRA)
CONSUMER PRODUCTS
(CPSA,
FFDCA,
FFA,
FHSA,
FIFRA,
PPPA)
(RCRA)
WASTE
TSCA
TSCA

• KEY •

CAA = CLEAN AIR ACT
CPSA = CONSUMER PRODUCT SAFETY ACT
FFDCA = FED. FOOD, DRUG, & COSMETIC ACT
FFA = FLAMMABLE FABRICS ACT
FHSA = FED. HAZARDOUS SUBSTANCES ACT
FIFRA = FED. INSECTICIDE, FUNGICIDE, & RODENTICIDE ACT
FWPCA = FED. WATER POLLUTION CONTROL ACT
HMTA = HAZARDOUS MATERIALS TRANSPORTATION ACT
OSHA = OCCUPATIONAL SAFETY & HEALTH ACT
PPPA = POISON PREVENTION PACKAGING ACT
RCRA = RESOURCE CONSERVATION & RECOVERY ACT
SDWA = SAFE DRINKING WATER ACT
TSCA = TOXIC SUBSTANCES CONTROL ACT

Figure 6-2

Hazardous Waste Control cradle to grave


off-site
recovery
treatment
transportation
disposal
generation
non-hazardous waste
on-site

Under the mandate of TSCA, an Interagency Testing Committee was established in February 1977. This Committee has the continuing responsibility to identify and recommend to the EPA Administrator chemical substances and mixtures which should be tested to determine their hazards to human health and the environment. It is composed of representatives of the Council on Environmental Quality, Department of Commerce, National Science Foundation, National Institute of Environmental Health Sciences (NIEHS), National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), and non-voting observers from the Department of Defense, Food and Drug Administration (FDA), Department of the Interior (DOI), and Consumer Product Safety Commission (CPSC).

Also under TSCA, an Interagency Toxic Substances Data Committee was established, comprised of 22 Federal agencies and their components, to facilitate interagency coordination in collecting, disseminating, and classifying chemical information. For the current membership of this Committee, *see* 44 *Fed. Reg.* 16959-60 (March 20, 1979).

Similarly, an Interagency Regulatory Liaison Group (IRLG) has been formed to protect the public from exposure to harmful levels of toxic substances from use of consumer products, foods, and drugs in the workplace; or through exposure to contaminants in land, air, or water. CPSC, EPA, FDA, and Occupational Safety and Health Administration (OSHA) joined forces in August, 1977 in response to the President's promise to eliminate waste and duplication in government. A fifth agency, the Food Safety and Quality Service in the Department of Agriculture (USDA), joined the group in December, 1978. The IRLG has targeted 24 chemical substances or hazards for initial priority control efforts. Another interagency effort was the National Toxicology Program established in late 1978 to combat the public health threat of chemical hazards in the environment by accelerating and improving Federal research, detection, and control efforts. The Program will also develop a long-range comprehensive plan to protect Americans from premature deaths, disease, and long-term illnesses associated with toxic substances in the environment. Participating agencies are NIOSH, NIEHS, FDA, and National Cancer Institute (NCI).

Despite there being Federal laws to protect the population from toxic and hazardous substances, millions of pounds of pesticides are improperly disposed of each year along with discarded containers.
Credit: EPA DOCUMERICA - Gene Daniels

Within EPA, a number of efforts are being made to consolidate toxics-related regulatory activities under several different statutes. For example, permits now required separately for discharges under the Clean Water Act (CWA), the Resources Conservation and Recovery Act (RCRA), the underground injection control program of the Safe Drinking Water Act (SDWA), and the prevention of significant deterioration program under the Clean Air Act, are being consolidated into a single permit program. A related example are final public participation regulations, published in February 1979, issued jointly under RCRA, SDWA, and CWA (44 *Fed. Reg.* 10285-97, Feb. 16, 1979).

A final example is draft hazardous waste generator rules issued by EPA in November 1978. Under these rules, generators of hazardous wastes must package or contain, label, and transport those wastes according to pre-existing Department of Transportation (DOT) regulations for hazardous materials shipments. These rules integrate EPA responsibilities under RCRA with the complimentary duties of DOT under the Hazardous Materials Transportation Act.

Are There Pieces Missing from the Picture?

With 18 or more Federal laws aimed at protecting us from toxic and hazardous substances, we may feel pretty well protected. But are we in fact adequately protected by existing laws? Or, are there gaps in the applicable control programs?

Gaps exist. The gaps are of various kinds; some inherent in the nature of the Federal system. For example, under the Constitution, the Federal government can regulate hazardous goods and waste products as they move through or affect interstate commerce. Where the effects are wholly intrastate or local, the Federal government has no power to intervene. In practice, this has not seriously impeded the comprehensive regulation of toxic substances because most activities interact in some way with interstate commerce. In addition, a number of the Federal toxics statutes—notably the pollution control laws administred by EPA—involve grant-in-aid programs to states and localities. Under these statutes, grantees assume primary responsibility for enforcing the requirements of the applicable Federal laws, and in turn agree to extend similar controls over more strictly *intra*-state activities. Since such devices do not involve direct Federal regulation (or coercion of states), they have thus far withstood constitutional challenge.

A more serious gap arises from the phased nature of many of the hazardous substance statutes and the desire to shift ever-increasing responsibility for implementation and enforcement to the states. "Phasing" is the practice of deferring the operational effectiveness of regulatory controls established by statute for a specified period of time until after the completion of one or more mandated activities. For example, if the EPA Administrator is given a year or more to complete the promulgation of environmental standards or discharge limits, these standards may then become effective 6 months or more later. Or, where a state is to assume control of a program, the state may have a year (and often a good deal longer) to submit implementing legislation and regulations added on to the time it took EPA to establish the initial Federal standards. And the dischargers who will have to abide by the state-established requirements will usually be given additional time to satisfy these requirements. It is not surprising that many of the important innovations of RCRA, passed in 1976, will only begin to be enforced against waste generators in the mid-1980's. For the same (and other) reasons, most of the pretreatment and toxic discharge controls established under the 1972 Federal Water Pollution Control Act Amendments are still years away from implementation.

Also, where phasing occurs, the statutes involved usually make provisions for "grandfathering" discharge sources already operating in compliance with prior law at the time new controls become effective. Such dischargers are often exempted from the need to comply with some or all of the controls that would become applicable to new sources of discharge.

While it is frustrating—waiting years for adequate laws to be enacted, then waiting many more years to see such laws fully implemented—the rationale behind the phased approach is easy to understand. For one thing, many of the toxic and hazardous substance controls that have been mandated in recent years require the setting of highly complex standards and regulations. It is difficult and time-consuming to develop standards and regulations which are (1) stringent enough to safeguard people and the environment, and (2) sufficiently well-grounded legally and scientifically to withstand judicial challenge. For another, even after defensible and adequate standards are adopted, the process and treatment changes that must then be instituted by industry to meet the standards take time and money to put into effect. Enforcement and monitoring capabilities by Federal, state, and local agencies, similarly, take time and scarce funds to establish.

On the other hand, where highly toxic chemicals are continuing to pour into the environment, threatening not only the well-being of fish and wildlife, but of whole ecological systems—to say nothing of the cancers, other diseases, and shortened life-expectancies produced in people—monetary considerations seem far less compelling by comparison.

One final gap which relates closely to those just described is the tendency of many of these Federal statutes to employ an explicit balancing test, whereby benefits to the environment and human health (from controlling toxic and hazardous substances) must be offset by the costs to industry and to those using their products (of restricting the availability or raising the price of chemicals used in the manufacturing process). Such an approach is based on the notion that some goods are so important as to outweigh the human suffering and environmental degradation that may result from the continued use of the toxic substances that go into their manufacure. A more sensible approach would seem to be to control processes to avoid unacceptable risks to health or the environment, irrespective of the value of the product produced. The costs of process control would then, of course, be added to the price of the product. If the product is sufficiently valuable, it will continue to be bought at the higher price. If the product is not important enough to society to still be needed when its pollutional "costs" are internalized, then it can only be deemed as being in the best interests of society that the product fall by the wayside.

What's the Enforcement Situation?

There's not much that can be said within the confines of this handbook about enforcement in the toxic and hazardous substances area, precisely because we are talking about 18 or more individual statutes and a much larger number of separate enforcement programs. As you might expect, the Federal government is not well equipped to investigate separately all of the tens of thousands of facilities involved in the generation, discharge, transportation, and use of hazardous substances. Federal agencies often have all they can do to issue permits as fast as the applications come in. There is seldom the opportunity to do extensive monitoring or inspecting to double-check the honesty or the accuracy of the permit applicant. Even where an agency believes enforcement action is warranted, such actions usually must be referred to the Department of Justice for prosecution. At this level, a local U.S. Attorney may have difficulty convincing himself to divert staff from prosecuting murderers and rapists to handle an environmental issue.

This is one of the reasons why you, a private citizen, are so important. You can call toxics problems to the attention of overburdened agency officials. And you can apply pressure on your elected representatives to make sure that violators of toxic laws are prosecuted. Private citizens can even, under many of the pollution control laws, secure their own legal counsel to prosecute toxics violators. Such "citizen suits" can usually be brought against federal agencies where the agencies fail adequately to discharge their mandatory statutory duties.

Potential risk to human beings and the environment from toxic chemicals exist everywhere at many levels of severity.
Credit: EPA DOCUMERICA - John Messina

How Can A Citizen Get into the Act?

If you are interested in influencing decisions at the Federal level, you'll have better luck starting with your state or region than with the offices in Washington, D.C. At the local level there may be advisory committees you can serve on to help in the planning process. At the Federal level, advisory committees tend to be more technically oriented. If it's information you're after, your best bet may still be the regional office—start with the toxic substances coordinator there. (See Appendix VI-2 for a list of EPA regional toxic substances coordinators).

In Washington, D.C., start your search with the EPA Office of Public Awareness; expect to make several calls. Also, try the Office of Industry Assistance (phone: 800-424-9065); both individuals and industries can get information about particular regulations.

As you make your calls, keep a log so you don't get sent around in a circle; inquire if there are advisory committees or mailing lists that furnish current reports in your area of interest.

You can gather a wealth of information from the *Federal Register* (available in depository libraries), environmental impact statements (available from issuing agencies), and public laws. If you know what you're looking for but are having a hard time getting it, you might try a Freedom of Information request. Let's explore what each of these is and how you might use it.

Getting Information from the Federal Register

Many laws enacted by Congress require federal agencies to issue regulations. Under a 1935 statute, a uniform system was established for filing proposed and final rules with the Office of Federal Register (part of the National Archives and Records Service within the General Services Administration). These documents are then published in the *Federal Register*, which is issued daily, Monday through Friday, except holidays. Documents in the *Federal Register* are usually cited by volume number, page, and date. For example, "43 *Fed. Reg.* 20060 (May 10, 1978)," refers to a notice appearing in volume 43 of the May 10, 1978 *Federal Register*, on page 20060.

The current general and permanent regulations of the various Federal agencies, as published in the *Federal Register*, are codified at least once each calendar year into the *Code of Federal Regulations (CFR). The CFR* is divided into 50 "titles" (major subject areas—e.g., title 36 on "Parks, Forests, and Public Property"), occupying approximately 140 volumes. (By contrast, the *United States Code*, which contains the current codified laws passed by Congress, occupies only about one-third of the shelving space required for the complete *CFR). Each CFR* title is divided into "chapters" which usually bear the name of the issuing agency. Each chapter is further subdivided into "parts" covering specific regulatory areas. The parts, in turn, are usually composd of "sections." Regulations in the *CFR* are usually cited by title, section number, and codification year. For example, "36 *CFR* §4.1 (1978)," refers to a regulation contained in title 36 of the *Code of Federal Regulations* volume codified in 1978, Section 4.1.

You can locate a particular regulation or document in the *Federal Register* or *Code of Federal Regulations* in one of these ways:

1. If you have the citation, you can simply look up the reference in a good public library, a local university law library, or a local court house.

2. If you don't have a citation, but know the approximate date the regulation was issued, and the regulation was issued within the last year, check the *Federal Register* "Contents" listing under the name of the issuing Federal agency. Under each agency name, there is a further division of entries into the types of documents published—Rules, Proposed Rules, Notices. Each rule and proposed rule published in the *Federal Register* indicates the *CFR* title, chapter, and part in which the rule has been or will be codified. Each document contains a preamble with seven captioned headings which highlight the key elements of the document, including pertinent dates, addresses, telephone numbers, and a brief summary of the document in layman's language. The cover of each *Federal Register* issue contains a listing of "Highlights" for documents appearing in that issue.

3. You can locate *Federal Register* documents by using a monthly index which lists all documents published in that month, arranged alphabetically by agency name, with broad subject headings inserted among the agency headings. The index is cumulated monthly, quarterly, and annually. The dex includes a Cumulative List of Parts Affected for the time period covered.

4. If the regulation you are seeking has been out for some time, chances are it is in the CFR. If so, the simplest way to find it is probably by referring to the appropriate *CFR* title. The back of every *CFR* volume contains: (a) a "Table of CFR Titles and Chapters," (b) an "Alphabetical List of Agencies Appearing in the CFR," and (c) a "List of CFR Sections Affected" year-by-year since 1964.

A *CFR* volume entitled "CFR Index and Finding Aids" contains a list of specific subjects as well as agencies, with references to the *CFR* titles and parts where the information appears. It also includes a table of authorities (i.e., statutes, executive orders, treaties) that have been cited for regulations in the *CFR*, a table of statutes with regulations requiring publication in the *Federal Register*, as well as a complete list of *CFR* titles, chapters, and parts.

If you have located a regulation in the *CFR*, and you want to be sure that it has not been amended since that volume was published, you should check the "List of Sections Affected" (LSA), a monthly, cumulative list of *CFR* sections affected by rule and proposed rule documents published since the last revision of each *CFR* title. The LSA includes a table of authorities that have been cited for regulations published in the *Federal Register* during the period covered. There is no longer a single annual issue of the LSA. The December issue is the annual for Titles 1-16; the March issue is the annual for Titles 17-27; the June issue is the annual for Titles 28-41; and the September issue is the annual for Titles 42-50. The monthly, quarterly, and annual *Federal Register* indexes, as noted previously, also contain a Cumulative List of Parts Affected for the time period covered.

The *CFR* titles which contain most of the Federal regulations involving toxic and hazardous substances are:

Title	Subject
21	Food and Drugs
29	Labor
33	Navigation and Navigable Waters
40	Protection of the Environment
42	Public Health
49	Transportation

Citizens and organizations interested in monitoring developments in a particular area of toxic substances or pollution law might wish to take advantage of the Federal Register Office's "Dial-a-Reg" service. By dialing one of three telephone numbers, callers can hear recorded summaries of highlighted documents appearing in the next day's *Federal Register*. These numbers are:

Washington, D.C. — 202-523-5022
Chicago, Ill. — 312-663-0884
Los Angeles, Calif. — 213-686-6694

If you are following new regulations being developed by the EPA—one of the most active agencies in the toxic substances area—a quarterly "Regulatory Agenda" published in the *Federal Register* will be helpful. This agenda publishes a summary of the significant regulatory actions under development by EPA so that interested parties can have an early opportunity to participate in shaping EPA's regulations. For an example of the agenda, see the November 30, 1978 *Federal Register* (43 *Fed. Reg.* 56158).

The Freedom of Information Act

The Freedom of Information Act, enacted in 1966, gives any person the right to receive copies of certain Federal documents. There are nine specific exemptions: (1) national security secrets, (2) internal personnel rules and practices, (3) privileged or confidential commercial or financial information, (4) memorandums or letters not available by law except to parties in litigation with the agency, (5) personnel, medical, and similar files, (6) investigatory files compiled for law enforcement purposes, (7) certain reports prepared for the use of the Securities and Exchange Commission, (8) certain geological information concerning wells, and (9) other documents exempted by statute.

Most Federal agencies have adopted specific regulations governing Freedom of Information Act (FOIA) requests. Consult these regulations to prepare and file your FOIA request. In most cases, you'll send your letter to a "Freedom of Information Act Officer." Make your request as specific as possible. If the recipient cannot identify the documents you want, obviously he cannot obtain them for you. The Act provides for agencies to charge requesters the direct costs of search and duplication. However, it authorizes agencies to furnish documents without charge or at a reduced charge "where the agency determines that waiver or reduction of the fee is in the public interest because furnishing the information can be considered as primarily benefiting the general public." Individuals and groups seeking toxic substances information in an effort to safeguard the environment and public health should be strong candidates for FOIA fee waivers. In your request letter (see samples on pp. 123, 128), make it clear that a fee waiver is sought and why you feel you are entitled to such a waiver.

Commenting on Environmental Impact Statements

The objective of the National Environmental Policy Act of 1969 is to integrate environmental considerations into the decisionmaking processes of all Federal agencies. To help meet this objective, agencies proposing actions that would significantly affect the quality of the environment are required to prepare environmental impact statements. These statements address impacts and alternatives associated with a proposed action.

Under guidelines established by the President's Council on Environmental Quality, agencies prepare draft environmental impact statements for circulation to other agencies and interested members of the public, who then have a period of time in which to submit written comments on the draft. When the final environmental impact statement is issued, it must address the major comments received on the draft and respond to them.

EPA publishes short summaries in the *Federal Register* each week of the draft and final environmental impact statements received during the preceding week from all Federal agencies. These notices give names and addresses of agency officials from whom copies of the statements can be obtained and indicate the deadline for submitting comments to the agency on each environmental impact statement.

If you're interested in toxic substances issues, keep track of the impact statements issued and request copies of those that seem relevant. If you submit comments on the proposed action, make sure you meet the deadline.

Participating in the Permits and Licenses Process

Many of the Federal laws regulating toxic substances include provisions for regulating the waste-generating activities of industries by means of a permit or license system. These statutes often specify that permits or licenses may be issued only following "notice and an opportunity for public hearing."

Federal agencies typically carry out the notice and hearing requirements by issuing "public notices"—usually to those who have requested to be placed on an established mailing list. These notices may also appear in the "Legal Notice" section of one or more newspapers of general circulation in the affected areas.

The public is usually given at least 15 days to respond to such public notices. Responses may be written comments on the permit proposal, requests for a public hearing to consider the application, or both. Where a proposed permit is a matter of local or national controversy, Federal agencies usually will hold public hearings to air both sides.

It is up to those who may be adversely impacted by these permits, if issued, to make sure they are included on public notice mailing lists, and to participate in permit proceedings—whether by submitting written comments or by requesting and taking part in public hearings.

Commenting on Proposed Regulations

The Administrative Procedure Act (APA) of 1946, generally states that the public has the right to participate in the rulemaking process by commenting on proposed rules.

Federal agencies must publish in the *Federal Register* a notice of proposed rulemaking which (1) decribes the proposed rule or the issues involved, (2) quotes the legal authority under which the rule is proposed, and (3) gives the time, place, and nature of public rulemaking proceedings.

After publishing the required notice, the agency must give interested persons a chance to submit written data, views, or arguments (with or without the opportunity for oral presentation). Usually, a minimum of 30 days is allowed for public comments on proposed rules.

The final rule, when issued, must include a concise, general statement of the rule's basis and purpose and will generally contain a response to the major public comments received.

Much important rulemaking will be going on in the next several years in the toxic and hazardous substances area. Industry can be counted on to follow closely the development of regulations which affect their interests. It is essential that private citizens—who will bear the brunt of the impacts of toxic substances in the environment, and who must ultimately foot the bill for control measures—participate fully in the regulatory process.

Compensation for costs of participating in a rulemaking proceeding

Section 6(c)(4) of TSCA authorizes the EPA Administrator, in certain circumstances, to provide compensation for reasonable attorney's fees, expert witness fees, and other costs of participating in the development of rules governing hazardous chemical substances and mixtures under section 6(a) of the Act. Compensation of this kind may be provided to persons who represent an interest "which would substantially contribute to a fair determination of the issues to be resolved in the proceeding," provided that the economic interest of such persons is small in relation to the costs of effective participation, and that such persons lack sufficient resources adequately to participate in the proceeding without compensation.

The details of the compensation mechanism must themselves be prescribed by regulation. By late November, 1979, such regulations had not yet been established.

Knowing how laws are referenced will help you understand them better

1. Federal legislation is published first as a "Slip Law," with a Public Law number (e.g., P.L. 92-500, the Federal Water Pollution Control Act Amendments of 1972, was law number 500 passed by the 92nd Congress).

2. These laws are then compiled annually in the "U.S. Statutes at Large" (e.g., 90 Stat. 2795, which is the citation to the Resource Conservation and Recovery Act of 1976, refers to the location of this statute in volume 90 of the Statutes at Large, beginning on page 2795).

3. Finally, public laws are codified in the "United States Code" (and the unofficial "United States Code Annotated"), which is arranged by major "titles" or subject areas (e.g., the Resource Conservation and Recovery Act of 1976 is codified at 42 U.S.C. §6901, *et. seq.*—that is, it can be found in title 42 of the United States Code in section 6901 and the sections that follow).

Congressional Legislation

A Guide Through the Congressional Maze*

Congress, also known as the legislative branch, is comprised of two bodies, the House of Representatives and the Senate. The terms *congressman, congresswoman, representative* and *member* are used to refer to persons elected to the House of Representatives. Senators, however, are always called Senators, except by people who get mad at them. Every state has two Senators who are theoretically responsible to every voter in that state. Congressmen, however, are elected by and are responsible only to the people in their own *congressional districts*, which are determined by population and state legislatures. Many Congressmen ignore anything and anyone from outside their own districts. *Constituents* are the voters to whom a Senator or Congressman is directly responsible, and to whom he/she is most likely to be responsive.

Congressmen are elected to terms of 2 years; Senators' terms are 6 years. Each Congress (here the term is used differently) lasts for 2 years, and is divided into two *sessions*. Thus the Congress of 1978-79 is the 96th Congress. Senate terms are staggered so that every 2 years one-third of the Senate is up for election. However, every member of the House is up for election every 2 years.

The Legislative Process

A *bill* is a piece of legislation before it is signed into law. House bills are numbered H.R. 000; Senate bills are numbered S. 000. At the beginning of each new Congress (every 2 years), the numbering starts at 1 (H.R. 1, S. 1, etc.).

When a congressman introduces a bill, it is referred to the *committee* which has jurisdiction over the subject matter in the bill. Committees are divided into *subcommitees* which specialize in various areas. For example, the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the House Merchant Marine and Fisheries Committee has jurisdiction over wildlife refuges, endangered species, predator control and similar subjects.

After a bill is referred to the appropriate committee, if there is enough pressure from its sponsors and the public and if the committee chairman likes the bill, a *hearing* will be scheduled. If none of the above are true, a hearing is never scheduled and the bill dies in committee.

The real work of Congress is done by the committees; it is they who actually write the legislation in the form in which it eventually proceeds to the full Senate or House of Representatives for a vote. Although occasionally a bill reaches *final passage* in the same form in which it was introduced, many of the more important bills are long and complicated and may be completely changed before they reach the *floor* of the House or Senate.

At a typical hearing, the Chairman of the appropriate subcommittee presides, and a few other members of the subcommittee will be present at least part of the time. (With the heavy demands placed on their time, members of Congress will most likely attend those hearings which they believe are most important to their constituents. They will usually attend a hearing if notified that one of their voters will be testifying.)

The bill's sponsors testify first, followed by government agency representatives. Usually these first two groups take up a great deal of time, leaving the remaining time for *public witnesses*, i.e., private citizens. Due to a shortage of time, witnesses are sometimes asked to summarize their testimony. This is particularly true of Appropriations Committee hearings where each witness may be allowed only 5 minutes. The full statement, however, is placed in the official hearing record for review. Hearings are the important first step in the legislative process and set the stage for the committee action.

After the hearings, the committee staff may start drafting changes in the bill as suggested by committee members and witnesses, and prepare a working document called a *committee print*. Mark-up means just what it says—the bill is marked up. Changes and additions (*amendments*) are made, usually by motions by committee members, and voted upon according to the committee rules of procedure which vary from committee to committee. After the amendments are considered, the committee votes on the bill and if a majority votes for it, it is *ordered reported*. If the bill has been totally rewritten, it may be given a new number through reintroduction as a *clean bill*. After the committee orders a bill reported, the staff then writes the *committee report*, which is an explanation of what the bill is supposed to do. It is part of the *legislative history* and is used by federal agencies as a guide to implementing the legislation, and by the courts in interpreting the law. Such committee reports are numbered, e.g., House Report 96-101 (the first number indicating which Congress, in this example, the 96th).

The report must be approved by a majority of the full committee, both majority and minority members, before it is printed and the bill is *reported*. (The majority party is the one which holds control in a given Congress; i.e., in the 96th Congress the Democrats are the majority party because they hold a majority of the seats in the House and Senate.) Occasionally, if there is a question about jurisdiction, another committee will request that the bill be *re-referred* to them. The second committee will then have a limited period of time in which to consider the bill, and may sugget amendments to it.

In the House, once a bill has been reported, the committee chairman requests a hearing before the *Rules Committee*, which schedules legislation on the floor. If the Rules Committee doesn't like the bill and no substantial pressure is put on the Committee, it dies, as happened with much of the early civil rights legislation. If the Rules Committee is favorably inclined, they *grant a rule* which comes in several forms, e.g., 2 hours of debate, 1 hour of debate, etc., which sets up the ground rules for floor action. (In the Senate this "traffic cop" function is performed by the majority leader, who decides what bills will be scheduled for floor action and when.)

The bill is then scheduled to come up on the floor for a vote. In the House, they vote on the rule, which means they vote whether they want to take up the bill. Once in a blue moon, a rule is rejected, as happened with the Timber Supply Act in 1970. This tactic, however, is rarely used. Congressmen are inclined to go along with whatever a committee recommends. However, any congressman may attempt to offer amendments on the floor. (Exception: bills that come

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*Reprinted with permission from National Audubon Society's *Guide for Citizen Action*, February, 1979.

under suspension of the rules. These are theoretically noncontroversial, and no amendments may be offered. A two-thirds majority vote is required for passage, however.)

If a congressman does wish to offer amendments to the bill, a floor fight ensues, unless an agreement is worked out in advance that the amendment will be accepted. The amendments are presented, debated to varying degrees, then voted upon. Since during most sessions very few congressmen are actually *on the House floor* (present in the chamber), the bells are rung to summon them to vote.

There are several forms of *votes:* oral or *voice votes,* which are decided by decibel level and not recorded; *division votes,* where the members stand up and are counted, but names are not recorded; *teller votes,* when members walk past a "teller" who counts them but does not record their names; *teller votes with clerks* and *roll call votes.* The latter two are recorded by name and published, and hence are preferable in that the public can learn who voted which way. However, in order to have a teller vote with clerks, 20 members must rise and demand this procedure. One-fifth of the members present must request a roll call vote.

The House has installed electronic voting equipment which speeds up teller votes with clerks and roll call votes considerably. However, the other forms of non-recorded votes are still used.

In the Senate, there are voice, division, and roll call votes, but nothing comparable to the teller vote procedure.

After the amendments have been accepted or rejected, there is a vote for final passage and the bill either passes or is defeated. If the House, for instance, passes a bill before the Senate has passed the same or a similar bill, the House bill is sent to the Senate where it is considered along with the Senate version (and vice versa).

If the two versions differ after the bill has passed both the House and Senate, a *conference committee* is appointed with members from the House and Senate committees which originally handled the bill. The conferees meet to work out a compromise—a process that can take many months with a controversial measure. Sometimes conferees never reach agreement, and the bill dies in conference. Then again, sometimes the conferees produce a bill that is quite different from the original measure passed (a good deal of horse-trading is done in conference).

After the conferees reach agreement, they take the bill back to their respective chambers, and the House and Senate usually vote routinely to accept the recommendations of the conferees.

The bill is then sent to the President for his signature. If he signs it, it becomes law and is thenceforth referred to as *Public Law Number 96 (the number of the Congress) -000.* If he vetoes it while Congress is in session, the Congress could override his veto with a two-thirds vote in both the House and Senate.

Authorizations and Appropriations

When Congress enacts a new program, the program usually requires funding. Thus, in the enacting legislation, Congress *authorizes* either a set or an indefinite amount of money. Sometimes there is a time limit, e.g., 5 years, on an authorization and sometimes it is indefinite. Just because legislation is passed does not mean that it will ever be carried (withholds the money from the agency) the unrequested money, which causes considerable irritation to Congress. out. Unless it is funded by the Appropriations Committees, the legislation in effect dies.

After funding has been authorized, the responsible agency must then ask for an appropriation from the Appropriations Committees. All appropriation bills originate in the House, but they must also be passed by the Senate.

The executive branch agencies submit their requests for funds each year to Congress via the Administration's budget. Often an agency will not request the entire amount which is authorized for a program, because the Office of Management and Budget (OMB) will not allow them to do so. Thus, OMB has great influence over policy through its control of the budget (OMB is an arm of the White House).

The Appropriations Committees frequently do not approve as much as the agency requests, but sometimes they appropriate more than the agency requests. When this happens, the White House, via the OMB, sometimes *freezes*

Congressional Committees

Among the Congressional committees and subcommittees which, from time to time exercise jurisdiction over toxic substances issues are:

Senate

- Committee on Agriculture, Nutrition, and Forestry
  - Subcommittee on Environment, Soil Conservation, and Forestry
- Committee on Commerce, Science and Transportation
  - Subcommittee on Consumer
  - Subcommittee on Science, Technology, & Space
  - Subcommittee on Surface Transportation
- Committee on Environment and Public Works
  - Subcommttee on Environmental Pollution
  - Subcommittee on Resource Protection
  - Subcommittee on Transportation
- Committee on Finance
  - Subcommittee on Health
- Committee on Governmental Affairs
  - Permanent Subcommittee on Investigations
- Committee on Labor & Human Resources
  - Subcommittee on Health & Scientific Research

House

- Committee on Government Operations
  - Subcommittee on Environment, Energy, & Natural Resources
- Committee on Interior and Insular Affairs
  - Subcommittee on Energy & the Environment
  - Subcommittee on Oversight & Special Investigations
- Committee on Interstate and Foreign Commerce
  - Subcommittee on Consumer Protection & Finance
  - Subcommittee on Health & the Environment
  - Subcommittee on Oversight & Investigations
  - Subcommittee on Transportation & Commerce
- Committee on Merchant Marine & Fisheries
  - Subcommittee on Fisheries, Wildlife Conservation, & the Environment
  - Subcommittee on Oceanography
- Committee on Public Works and Transportation
  - Subcommittee on Oversight & Review
  - Subcommittee on Water Resources
- Committee on Science and Technology
  - Subcommittee on Natural Reources & Environment
  - Subcommittee on Science, Research, & Technology

Reports on Congressional Activity

The *Congressional Record* is a verbatim transcript of legislative debates and proceedings, subject to revision by Members of Congress. It is published each day that either the House or the Senate is in session. There is an appendix to the *Congressional Record* which includes extensions of floor remarks, exhibits from legislators, communications on pending legislation, hometown speeches, and almost anything else a Congressman wishes to get into the Record. There is a *Daily Digest* in each issue, a fortnightly index, and at the end of the session, a bound edition made up of over 20 volumes which include a cumulative index (with entries by subject, title, and Congressman), a cumulation of the Daily Digest, and a complete History of Bills and Resolutions for that session. The Appendix, although not included in the bound set, is available in microfilm.

The *Congressional Record* is a useful tool for following current legislative developments on Capitol Hill. The debates it contains also constitute an important part of the legislative history of enacted legislation.

The National Wildlife Federation publishes a *Conservation Report*, which provides a weekly update on conservation and environmental legislation when Congress is in session. Other organizations also report on ongoing environmental activities in Congress. These newsletters and alerts can be very useful in informing interested citizens of important legislative developments on Capitol Hill.

Citizen Action at the Federal Level

1. Rulemaking

A Federal environmental law is only as good and as protective of the environment as the agency regulations established to carry out the law's requirements. In the toxic substances field, the chemical industry follows closely new regulations which may affect its interests and routinely suggests weakening changes to such regulations. It is, thus, exceedingly important that interested citizens—who are directly affected when toxic chemicals are released into the environment—strive to make known *their interest* in stronger rather than weaker toxic substances regulations.

Under the Administrative Procedure Act, most Federal regulations before they take final effect must be published in proposed form in the *Federal Register*. Then the public has a set time period in which to review them and make comments.

Specific comments and positive suggestions are usually better received by regulatory agencies than general and emotional expressions of concern and outrage. These regulations tend to be lengthy and complex, however. And if detailed, specific comments are beyond your capabilities, even general expressions of concern can be useful in reminding the agency that its mission is to protect the public.

Although it is easy to be intimidated by toxic substance regulations, there is really no reason why well-motivated citizens of average intelligence cannot do as good a job as any lawyer or scientist in evaluating a proposed agency regulation. All the skills and information sources necessary are described in this handbook.

In evaluating proposed agency regulations, first read the statute which the regulation is supposed to be implementing. Often, an agency responding to competing pressures will make compromises—sometimes of questionable conformity with the intent of Congress—in the regulations it adopts. Next look up the statutory provisions relied upon, and make sure that the regulations fully accomplish the letter and intent of the statute. If they don't, point out this deficiency to the agency which proposed the regulations.

Also look closely at the exceptions which the regulations establish to the basic regulatory approach. Often the exceptions swallow up the rule. Make sure that the exceptions are authorized by the statute, and that they are otherwise reasonable and justifiable. If they are not, point this fact out to the agency in your comments.

2. Public Hearings

Federal agencies constantly hold public hearings on a variety of subjects and for a variety of purposes. These hearings are often widely attended by representatives of the press. You can use these hearings to get your views heard and have them taken seriously. You will be testifying alongside major corporations, so choose carefully which public hearings you wish to participate in and prepare your testimony carefully.

Public hearings and public meetings vary in their formality. Sometimes a hearing or meeting will be called to entertain public views on proposed regulations—particularly controverial ones. Any citizen can attend and participate. Those wishing to speak are usually asked to register at the meeting hall, and are called upon to present their remarks in the order of their registration (sometimes Federal, state, and local officials are allowed to speak first regardless of when they registered). A hearing officer or hearing panel usually presides over the meeting and appreciates hearing the views of interested citizens. If the public hearing setting intimidates you, attend a few hearings as an observer first.

Public hearings are often called as part of the review of various kinds of Federal permits. In many cases, agencies are allowed to issue permits only after they give public notice and allow "an opportunity for a public hearing." Hearings are generally reserved for the most controversial kinds of activities. Any interested citizen can request a public hearing in connection with any proposd permit action. However, agencies usually grant the request only where specific factual or legal issues have been identified in the request which might be resolved by holding the requested hearing. Agencies understandably do not want to go to the trouble and expense of holding a public hearing unless they have some reason to expect that the hearing will yield relevant information to assist them in making their decision.

If there are permit programs of interest to you or your community, contact the regional, district, or state office of the permit-issuing agency; ask to be placed on the agency's permanent mailing list for public notices announcing the receipt of permit applications under the given program. Indicate the geographic area you want to monitor (i.e., the whole region, your state, your county, a particular waterway, etc.). If the public notices you receive are not sufficiently informative (their quality differs widely among agencies and offices), let the issuing agency know this and recommend ways of improving their usefulness.

You can send the responsible agency written comments expressing your views and concerns without requesting a public hearing. Be sure to reference properly the public notice you are commenting on, so that your comments are appropriately considered in connection with the correct project.

3. Citizen Petitions

A number of toxic substances statutes provide for formal citizen petitions seeking specified actions—usually on the part of the EPA Administrator. A legal petition of this kind bears no resemblance to political petitions, which are used to get political candidates on an election ballot, or to get support for a referendum on an issue of public concern. A legal petition is a memorandum which sets forth facts and legal contentions aimed at persuading a decision-making official to adopt a particular course of action.

A great deal of care must go into the design of a persuasive legal petition. While legal and scientific assistance is helpful in drafting such a petition in most toxic substances situations, the skills required are within the capabilities of ordinary citizens—given sufficient interest and diligence.

4. Influencing Legislation

Many good guides exist, and are listed in the annotated bibliography, as to how to have the greatest impact on congressional legislation. Only a few basic pointers will be provided here.

One rule of thumb is that most of the action occurs in committee. (*See,* Figure 6-3.) The responsible committee or committees play a major role in shaping the bills that ultimately are voted upon by both houses of Congress. Equally important, the committee decides whether a particular bill emerges at all for further congressional consideration. So it is essential to monitor the progress of legislation of interest and to make your views known to members of the relevant committees at appropriate stages in the process.

For introduction and passage of new legislation, the best approach is usually to work through your own Representative or Senator. He or she can sponsor or co-sponsor a bill, testify before relevant committees, insert supportive material into the *Congressional Record,* and generally help persuade colleagues of the merits of such legislation.

Tips for good letter writing to a member of Congress include the following:

1. Keep your letter short, concise, and in your own words.
2. Limit your letters to one subject per letter.
3. Educate your congressman to your point of view by using local examples, if possible.
4. Time your letter writing to coincide with committee consideration.
5. Use common sense; don't be offensive.
6. Use positive reinforcement; if your congressman responds favorably to a request, or votes the right way on an issue of concern to you, it is important to thank him for doing so.
7. Use Public Opinion Messages—telegrams which are short and inexpensive.

Form or join a coalition or other organized group. There is strength in numbers, especially in politics.

In the toxic substance area, the issues involved are often quite complex; in order to have positive impact on legislation, you need to know what you are talking about. Be as helpful as you can in providing information and clarification. Become known as a reliable source. It will greatly enhance your effectiveness.

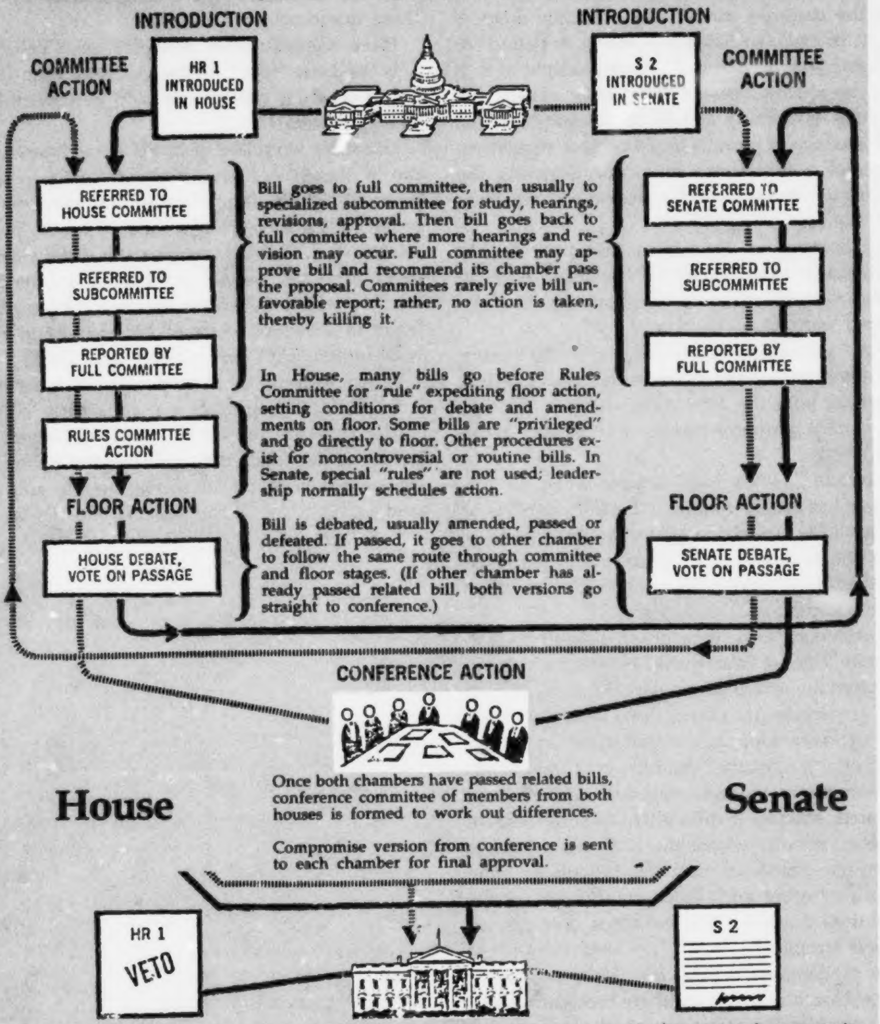
5. Litigation

Lawsuits are of limited educational value. They are an expensive and time-consuming way to dramatize your position. Litigation is essentially a legal battle among lawyers and should always be treated as a last resort. It should be used only when: (a) you are convinced you are right; (b) all other efforts at convincing the agency, company, or individual fail; and (c) the issue you propose to litigate is important

Figure 6-3

How A Bill Becomes Law

This graphic shows the most typical way in which proposed legislation is enacted into law. There are more complicated, as well as simpler, routes, and most bills fall by the wayside and never become law. The process is illustrated with two hypothetical bills, House bill No. 1 (HR 1) and Senate bill No. 2 (S 2). Each bill must be passed by both houses of Congress in identical form before it can become law. The path of HR 1 is traced by a solid line, that of S 2 by a broken line. However, in practice most legislation begins as similar proposals in both houses.


INTRODUCTION
INTRODUCTION
COMMITTEE ACTION
HR 1 INTRODUCED IN HOUSE
S 2 INTRODUCED IN SENATE
COMMITTEE ACTION
REFERRED TO HOUSE COMMITTEE
REFERRED TO SENATE COMMITTEE
REFERRED TO SUBCOMMITTEE
REFERRED TO SUBCOMMITTEE
REPORTED BY FULL COMMITTEE
REPORTED BY FULL COMMITTEE
RULES COMMITTEE ACTION
FLOOR ACTION
FLOOR ACTION
HOUSE DEBATE, VOTE ON PASSAGE
SENATE DEBATE, VOTE ON PASSAGE
CONFERENCE ACTION
House
Senate
HR 1
VETO
S 2

Bill goes to full committee, then usually to specialized subcommittee for study, hearings, revisions, approval. Then bill goes back to full committee where more hearings and revision may occur. Full committee may approve bill and recommend its chamber pass the proposal. Committees rarely give bill unfavorable report; rather, no action is taken, thereby killing it.

In House, many bills go before Rules Committee for "rule" expediting floor action, setting conditions for debate and amendments on floor. Some bills are "privileged" and go directly to floor. Other procedures exist for noncontroversial or routine bills. In Senate, special "rules" are not used; leadership normally schedules action.

Bill is debated, usually amended, passed or defeated. If passed, it goes to other chamber to follow the same route through committee and floor stages. (If other chamber has already passed related bill, both versions go straight to conference.)

Once both chambers have passed related bills, conference committee of members from both houses is formed to work out differences.

Compromise version from conference is sent to each chamber for final approval.

Compromise version approved by both houses is sent to President who can either sign it into law or veto it and return it to Congress. Congress may override veto by a two-thirds majority vote in both houses; bill then becomes law without President's signature.

Reprinted with permission by Congressional Quarterly enough to justify the large amount of money and time it will take to pursue the litigation.

Lawsuits are sometimes useful and necessary. Major environmental and conservation organizations frequently find they must go to Court—often against a Federal agency which has failed to go far enough to safeguard human health and the environment.

The two main kinds of lawsuits which might be utilized in connection with toxic substances problems are the injunction action and the damages action. The *injunction action* is generally brought in order to halt some action or pattern of conduct by an agency or private entity. For example, if it is believed that a regulation doesn't adequately satisfy the requirements of the governing statute, an order might be sought to forbid issuance of permits based on that regulation. One might also seek a mandatory injunction directing the agency to promulgate revised regulations which meet the requirements of the law.

In the private context, an injunction might be sought against an individual or company which is causing harm to the environment in violation of an applicable permit (or without a required permit).

The "citizen suit" provisions of a number of Federal environmental statutes authorize injunction actions under certain circumstances against both the EPA Administrator (for failure to perform certain nondiscretionary duties) and recalcitrant private parties.

The second kind of lawsuit is a *damages action*. In this situation, a polluter has caused economic harm to persons or property and a lawsuit is brought to secure monetary redress. Such lawsuits do not usually involve claims under particular statutes; rather, they arise under the court-made "common law" of nuisance, trespass and negligence.

In the toxic substances area, it is often difficult to adequately demonstrate a direct relationship between a particular discharge or activity and a particular injury to human health and the environment. Often, low levels of toxic chemicals build up over long periods of time and exert chronic, sublethal effects long after the release of the chemicals has ended. Sometimes multiple polluters all contribute chemicals to an area, making it difficult to allocate responsibility among them. Finally, where the chemical release is not illegal under any statute, it may be difficult to demonstrate negligence or other culpability on the part of the releasor. In other than the most clear-cut cases, damages actions are an uphill struggle.

A special type of damages action, the "class action," is worth mentioning. Lawsuits of this kind are brought when a large number of individuals suffer a low-level of injury as a result of a polluting (or other) activity. The level of injury is not sufficient to make it worthwhile for any individual victim to pursue legal remedies. However, the aggregate monetary damage can be quite large. Class actions are devices for bringing damage suits on behalf of a large class of affected individuals.

The major beneficiaries of class action suits are often the lawyers that bring them, since the recoveries to any individual member of the class are likely to be small (particularly after legal fees are subtracted). Moreover, in the Federal context, class action suits have been made especially difficult to initiate by court decisions which require personal notice to all members of the class—numbers which may reach into the millions.

Before embarking upon litigation of any kind, consider these questions:

Have administrative remedies been exhausted?

Is the issue "ripe" for judicial resolution (i.e., has it gelled into a clear-cut controversy, and is it more than just an abstract problem)?

Does the would-be plaintiff have "standing" to sue (i.e., can he show that he has suffered "injury-in-fact" and that his injury is within the "zone of interests" sought to be protected by the governing statute)? Has the proper court been selected (i.e., Federal versus state; district court or appellate court; and the "venue" or location of the Federal or state court in which the action will be brought—e.g., will a challenge to a Federal decision be brought in Federal court in Washington, D.C. or in New York City)?

Where a group or individual contemplates legal action, it is a good idea to prepare a short, clearly written description of the key facts for submission to a lawyer. The better the lawyer understands the problem, the better will be his advice as to whether a lawsuit is feasible and is likely to succeed.

Chapter VII Summary

Case Study in New Jersey

A general method is developed for pinpointing and studying those industrial plants in a local area most likely to pose health and environmental risks because of toxic discharges into waterways. This general method is applied, for illustrative purposes, to the State of New Jersey.

New Jersey was selected primarily because it is heavily industrialized and has serious problems with toxic substances, including the highest cancer rate in the U.S.

A stepwise approach is used to locate plants for study:

(1) Select hazardous industries, using EPA and other lists of such industries;

(2) Select and classify hazardous industries important in the area being studied;

(3) Determine the number of plants with discharge permits within those hazardous industry classifications for each river basin in the state;

(4) Select the river basin with the greatest number of such plants for further study;

(5) Obtain a list of indirect dischargers (those which discharge to a publicly owned sewage treatment plant);

(6) List indirect dischargers into the selected river basin in the previously selected hazardous industry classes;

(7) Obtain preliminary information about the "hazardous" plants directly or indirectly discharging into the selected river basin, using NPDES permits and other sources;

(8) Choose, from information obtained under (7), a group of plants for more intensive study.

Chapter VII

Case Study in New Jersey

Citizen Opportunities on the State Level

Most citizen efforts in toxic control will be at the local level. Chapter X gives you direction for that kind of campaign.

However, some projects need regional or state coordination. Most of the procedures suggested for local action are directly translatable to regional/state work. For example, the way to identify and contact state support groups would be approximately the same as for local efforts—only on a larger scope.

As you read the following description of how one trouble spot was explored in New Jersey, you will see how a similar situation could be dealt with in your state or community.

This case study was conducted by professionals in order to develop the most thorough and effective plan for citizen investigation. You may not have the time or resources to use every step of the process; use what you can.

Study of New Jersey

Pinpointing Risks

As you have seen, potential risks to the environment and human beings from toxic chemicals can arise from industrial activities. These risks exist everywhere, in many varieties and levels of severity.

If you are to protect yourself and your community by taking action to reduce those risks, you need some way to determine what they are. Since there will probably be many risks, you also need a way to select those likely to be most serious and threatening.

Each community has its unique risks. However, universal techniques are helpful in finding and evaluating problems in your own local situation.

The following sections outline a general method and apply it to a particular area. To simplify the process, the procedure is confined to risks arising from the discharge of toxic substances by industrial plants directly into a river system.

New Jersey was picked as the site for this case study primarily because the State is heavily industrialized and is known to have serious problems with toxic substances, including the highest cancer rate in the country. The procedure outlined is applicable, with suitable modification, to any section of the U.S.

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it."

—Justice Oliver Wendell Holmes

Discharges Into Rivers

One of the ways we dispose of waste materials is by putting them down a sewer. In our homes we flush the toilet or pour things into the sink. These wastes are conveyed first to a sewer and then—in a stream of water—to a pond, river, stream, lake, or other body of water. Usually the wastes (sewage) are treated somewhere along the way (septic tanks, sewage treatment plants) before entering a waterway, to make them less obnoxious.

Industrial plants, like homes, produce wastes which have to be removed. They, too, often flush their wastes down a sewer. Industrial wastes arise in many ways, principally from plant processing (rinsing, cleaning, or removing ingredients used and products made in the plant) and plant housekeeping (washing trucks, cleaning equipment, rinsing plant floors and walls). If toxic substances are used or produced in a plant, you can be reasonably sure that some or most of these substances end up in the wastewater which goes into the sewer.

Just as with household wastes, industrial wastewater ends up in a river, lake, or other body of water, usually with some kind of treatment along the way. However, unlike household wastes whose pollutant content can be efficiently eliminated by conventional sewage treatment, many industrial wastes are not effectively treated.

"The objective of the Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 1972 Amendment to the Federal Water Pollution Control Act.

Water Discharge Permits (NPDES Permits)

Problems due to polluted water were recognized in the 19th century. Attempts were first made by local government agencies to control such pollution. When they were unable to handle the problem, state agencies took over. By 1960, most states had water pollution control departments. Effectiveness of state programs for control varied greatly.

The first Federal law affecting water pollution, the Refuse Act of 1899, was primarily aimed at protecting navigation. The first Federal Water Pollution Control Act was passed in 1948; it was weak and ineffective in halting the deteriorating quality of the Nation's waters.

A series of amending laws were passed by Congress in the fifties and sixties, followed by the Water Pollution Control Act Amendments of 1972 and the Clean Water Act of 1977.

The 1972 Act set up a Federal system under which everyone discharging wastewater into a waterway must apply for and receive a permit.

The applicant must fill out an application which requests certain basic information on the plant and its wastewater. The government may then issue a permit describing the conditions under which the wastewater may be put into the waterway. These permits, called NPDES permits (National Pollutant Discharge Elimination System), are one source of information in determining the origin of risks from toxic substances in water in your community.

This permit system was not designed to pinpoint specific toxic substances, but rather was focused toward conventional pollutants. Conventional pollutants are traditional sewage pollutants which exert an overall effect on water quality, such as pathogenic bacteria, biological oxygen demand (BOD), suspended solids (SS), acidity (pH), and temperature.

Although EPA is in the process of redesigning the permit application to include more useful information concerning toxics, the permit application currently deals only superficially with the nature of these discharges.

In the sections that follow, we shall see the usefulness of this permit system. We shall also uncover serious limitations, especially that the 1972 Act focuses on so-called "conventional pollutants," leaving almost uncontrolled the far more hazardous "toxic substances." The Clean Water Act of 1977 attempts to correct this deficiency, but as yet, little progress has been made. We will examine permits and permit applications later in our discussion.

Hazardous Industries

There are likely to be a large number of NPDES permits in your state or community. In the State of New Jersey, there are just over 1,000 such permits. In order to use these permits effectively to pinpoint polluters posing the greatest risks, a method is needed to select those most likely to be discharging toxic substances.

Obviously, a firm processing milk or weaving carpets is less likely to be a source of toxic chemicals than a plant manufacturing pesticides or using a cyanide solution to electroplate metals. We can assess the likelihood that a firm presents a toxic hazard simply from the kind of business it is in.

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it." —*Justice Oliver Wendell Holmes* Credit: NWF

Federal agencies have prepared lists ranking industries according to the toxic hazards they present. The following is a discussion of three such lists.

1. In 1977, EPA published the results of a 17-industry study it had made, rating these industries as to their importance as generators of hazardous wastes. (Top polluters in this study are listed in Table 7-1.) Importance as a generator of hazardous solid wastes is not necessarily the same as importance as a generator of toxic substances in wastewater discharges. But as you will quickly find as you try to pinpoint toxic hazards, the information you need is sometimes hard to get, and you do the best you can with what is available.

2. Another study made by EPA concentrated on 21 principal industries believed to be discharging into waterways the toxic substances of greatest health and environmental concern. Of these 21 industries, there were 8 selected by EPA to be handled first. Table 7-2, listing the 21 industries, has the 8 selected for first action indicated by asterisk.

3. The Occupational Safety and Health Administration (OSHA), in a study made for the Agency in 1977 by a consultant firm, listed "High Health Risk Industries," i.e., industries using the greatest number of hazardous substances. This study was made for OSHA as part of "A Study of Occupational Safety and Health Training Program Alternatives and Priorities." The list, Table 7-3, consists of those industries using or producing the greatest number of chemicals which cause chronic human health problems.

Comparison of the three lists shows a marked similarity. Except for electroplating and textiles, the seven industries listed at the top of EPA's list of hazardous waste generators appear on all three lists.

We will return to these lists after a short detour to show you how industries can be identified by numbers rather than by verbal descriptions.

Classifying Industries by SIC Codes— "By the Numbers"

In the preceding section, we discussed hazardous industries and three different lists of such industries. The list from OSHA has, as its first column, just before the name of the industry, a three-digit number (for example: 281—industrial inorganic chemicals).

This number is the so-called "Standard Industrial Classification," or SIC code. This code systematically classifies all economic activities in the U.S., dividing them into groups and subgroups. Each group is assigned a number. Major groups are assigned two-digit numbers and these are subgrouped into three- and then four-digit numbers. For example:

SIC 10	metal mining
SIC 104	gold and silver ores
SIC 1041	gold ores
SIC 28	chemicals and allied products manufacturing
SIC 286	industrial organic chemicals
SIC 2861	gum and wood chemicals

Table 7-1

Industries Which Are Major Hazardous Waste Generators

Million Metric Tons (Wet Basis) (1977 Estimates)	
Organic Chemicals	11.7
Primary Metals	9.0
Electroplating	4.1
Inorganic Chemicals	4.0
Textiles	1.9
Petroleum Refining	1.8
Rubber & Plastics	1.0
Misc. (7 Sectors)	1.0
TOTAL	34.5

From: "Water Information News Service," Environmental Protection Agency, Washington, D.C., December 22, 1978.

Table 7-2

21 Industries of Greatest Environmental Concern

Auto and Other Laundries
Coal Mining
Electroplating*
Inorganic Chemicals Manufacturing*
Iron and Steel Manufacturing
Leather Tanning and Finishing*
Machinery and Mechanical Products Manufacturing
Miscellaneous Chemicals Manufacturing
Nonferrous Metals Manufacturing*
Ore Mining
Organic Chemicals Manufacturing
Paint and Ink Formulation and Printing
Paving and Roofing Materials
Petroleum Refining*
Plastic and Synthetic Materials Manufacturing
Pulp and Paperboard Mills and Converted Paper Products
Rubber Processing
Soap and Detergent Manufacturing
Steam Electric Power Plants*
Textile Mills*
Timber Products Processing*

*Industries receiving priority attention in development of pretreatment standards

From: **Information for Proposed General Pretreatment Regulations.** *U.S. Environmental Protection Agency, Office of Planning and Evaluation, Washington, D.C., March 1977.*

Table 7-3

High Health Risk Industries
Industries Using Greatest Number of Hazardous Substances

3-Digit SIC	Total Employment (thousands)	Production Workers (thousands)	Number of Establishments with 1 to 49 Employees	Estimated Number of Production Workers in Establishments with 1 to 49 Employees (thousands)
281-Industrial inorganic chemicals	321.9	173.1	866	9.5
282-Plastics materials & synthetics	229.8	157.2	293	3.4
283-Drugs	164.7	82.3	804	8.2
285-Paints and allied products	70.5	38.7	1,172	14.7
286-Industrial organic chemicals	55.8	34.2	426	5.0
287-Agricultural chemicals	52.9	32.9	962	10.3
289-Miscellaneous chemicals products	37.2	22.8	2,053	20.5
291-Petroleum refining	154.8	94.2	164	2.1
301-Tires and inner tubes	130.2	94.5	114	1.3
304-Rubber & plastics hose & belting	92.3	72.9	50	0.7
306-Fabricated rubber products, n.c.c.	92.3	72.9	707	9.4
307-Miscellaneous plastics products	361.2	290.0	5,897	69.6
331-Blast furnace & basic steel products	609.0	486.9	481	6.4
332-Iron & steel foundries	247.3	207.0	591	9.4
333-Primary nonferrous metals	33.7	37.5	100	1.1
334-Secondary nonferrous metals	58.3	43.8	272	3.1
336-Nonferrous foundries	93.5	78.4	1,343	5.9
339-Miscellaneous primay metal products	79.4	64.0	876	11.3
369-Miscellaneous electrical equipment & supplies	139.2	108.7	1,043	10.4
TOTALS	3,024.0	2,182.0	18,214	202.3

from: "A Study of Occupational Safety and Health Training Program Alternatives and Priorities", U.S. Occupational Safety and Health Administration, October 20, 1977.

Every industrial activity can be assigned a four-digit SIC code number.

The U.S. Government publishes *The Standard Industrial Classification Manual,* sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock No. 041-001-00066-6). This manual lists and describes all SIC two-, three-, and four-digit code classifications. A sample page from the manual is in Appendix VII-1.

Local Hazardous Industries

How do you spot the plants in your locality whose wastewaters present the greatest possibility for harm to you and your environment?

We are using the State of New Jersey for illustration. The same method is applicable to any state. If you are interested in a smaller area, such as a county or town or river, or a cluster of industrial plants, you would consider only the industries in that smaller area.

The general procedure is to determine the industries of greatest significance to the geographic area in which you are interested. By comparing these local industries with the national list of hazardous industries, the local ones which are hazardous can be pinpointed.

The first step, then, in defining hazards in your area is to determine what industries are important in that area. You can get that information from state and local government agencies and from business associations such as Chambers of Commerce. Nationally, the most general references are:

U.S. Department of Commerce has available a great deal of data including the "U.S. Survey of Manufacturers," "Annual Survey of Manufacturers," "City and County Data Book," and "County Business Patterns Data."

The *Bureau of Labor Statistics, U.S. Department of Labor,* also has useful information, especially its "Employment and Earnings, States and Areas, 1939-1975" published in 1976.

For New Jersey, the desired information came from the *U.S. Survey of Manufacturers,* 1975, obtained from the U.S. Department of Commerce. Table 7-4 lists information on New Jersey's major industries—their two-digit SIC code, number of people employed, value added by the manufacturing process in New Jersey, and the percent of this dollar value which is added in New Jersey as compared to the total value added by that industry in the United States.

Since our interest is focused on major hazardous industries, the next step is the coordination of how New Jersey's major industries (Table 7-4) compare with the lists of hazardous industries in Tables 7-1 through 7-3.

From this coordination, we arrive at a *list of hazardous industries in New Jersey* by major classifications: textile mill products (SIC 22), chemicals and allied products (SIC 28), rubber and miscellaneous plastics products (SIC 30), and primary metal industries (SIC 33). Of these, chemicals is by far

Table 7-4

Major Industry Classifications in New Jersey (Annual Survey of Manufacturers, 1975)

SIC	Industry	Employment	Value Added in NJ (million dollars)	New Jersey of U.S. (%)
20	Food and Kindred Products	34,000	1,852.7	3.8
22	Textile Mill Products	21,400	389.9	3.2
23	Apparel, Other Textile Goods	61,200	724.8	5.4
24	Lumber and Wood Products	4,500	85.9	.8
25	Furniture and Fixtures	8,200	159.8	2.5
26	Paper and Allied Products	28,100	744.2	4.2
27	Printing and Publishing	38,700	892.9	3.6
28	Chemicals and Allied Products	95,700	4,826.9	10.7
30	Rubber, Misc. Plastics Products	31,100	644.3	4.7
31	Leather, Leather Products	8,400	127.2	4.0
32	Stone, Clay, Glass Products	32,100	875.7	5.7
33	Primary Metal Industries	25,600	652.9	2.1
34	Fabricated Metal Products	48,400	1,190.4	3.5
35	Machinery, Except Electrical	61,900	1,389.3	2.7
36	Electric, Electronic Equipment	71,900	1,462.3	4.2
37	Transportation Equipment	21,900	901.7	2.0
38	Instruments, Related Products	28,500	670.3	4.8
39	Misc. Manufacturing Industries	21,400	401.3	5.2

the most significant, contributing a dollar value about eight times as great as either rubber and miscellaneous plastic products or primary metal industries.

From the New Jersey Department of Environmental Protection, we learned that this state, with only 0.21 percent of the nation's land area, and 3.5 percent of the U.S. population, accounts for 12.4 percent of the nation's chemical production. The chemical industry is by far the dominant industry in New Jersey.

Since the chemical industry is so important in New Jersey, and since that industry is included in all three lists of hazardous industries (Tables 7-1, 7-2, 7-3), the chemical industry (SIC code 28) warrants major attention in ferreting out prime suspects as potential toxic wastewater dischargers.

Further checking in reference books and with New Jersey Department of Environmental Protection officials, revealed that the chemical industry is highly diversified, producing a wide range of products. Since classes of chemicals vary widely in their toxicity, more detailed statistics were obtained on major chemical (SIC) classifications in the State.

Table 7-5 was obtained from the Department of Commerce's 1976 Survey of Manufacturers which lists some of the SIC three-digit subgroupings of the major SIC class of "Chemicals and Allied Products."

Because New Jersey is so heavily industrialized, the number of plants within the four major SIC groups selected as most hazardous is very large. To make the study manageable, it was necessary to limit the number of plants examined.

Computer data on plants can be obtained using either two-digit or four-digit SIC classifications—more about this later. To limit the number of hazardous plants reviewed, you can select some of the many four-digit classes which fall within the two-digit groups (SIC 22, 28, 30, 33) under consideration.

This selection of four-digit industries was made as follows. It was arbitrarily decided that:

(1) about 20 four-digit industries would be selected;

(2) major attention would be given to chemicals, since this industry is dominant in New Jersey;

(3) textile mills would be eliminated, since this industry does not appear on the OSHA list, Table 7-3;

(4) petroleum refining would be eliminated because hazards from this industry lie mainly in the disposal of toxic wastes by means other than through discharges in wastewater (in the air, in spills and leaks, and in landfills).

In addition, specific four-digit categories in Classes 28 and 33 were examined. (Classes 22 and 30 were eliminated, being less significant than Classes 28 and 33 as sources of toxic substances in New Jersey.) There are 28 four-digit classifications in Class 28 (chemicals) and 26 in Class 33 (primary metals).

The description of each of these 54 classifications as contained in the SIC manual was carefully reviewed with the goal of selecting about 20 industry classes most likely to pose problems to health and the environment by discharge of toxic substances in their wastewater. Such selection requires judgment. If you follow such a selection procedure, it is desirable that you consult with an experienced person, who knows the industry. Your alternative, if you do not have access to such a person, is to use the entire two-digit classification, rather than select four-digit subgroups.

In our case, we selected 15 four-digit subgroups in chemicals, three in metals and one in an entirely different major group (SIC 3471—Electroplating—an industry which has received considerable attention as an industry of many small companies handling very toxic materials).

Table 7-5

Major Groupings of the New Jersey Chemical Industry (1976 Survey of Manufacturers)

SIC Code	Industry Group	Number of Employees	Value Added ($ million)	New Capital Expenditures ($ million)	Share of U.S. Total Value Added
28	Chemicals, Allied Products	94,300	5,626.0	373.3	10.9%
281	Industrial Inorganic Chemicals	4,200	188.5	11.7	3.1%
282	Plastics Materials, Synthetics	5,900	283.6	24.3	4.3%
283	Drugs	28,100	2,130.0	90.7	22.9%
284	Soaps, Cleaners, Toilet Goods	21,800	1,334.9	35.7	15.7%
2851	Paints and Allied Products	5,200	233.7	14.6	9.1%
286	Industrial Organic Chemicals	20,000	1,046.5	158.2	9.2%
289	Miscellaneous Chemical Products	7,700	290.8	18.9	9.3%

Table 7-6

Hazardous Industries Included in New Jersey Study of Dischargers

SIC Code	Industry
2816	Inorganic Pigments
2819	Industrial Inorganic Chemicals, Not Elsewhere Classified
2821	Plastic Materials, Synthetic Resins and Nonvulcanizable Elastomers
2822	Synthetic Rubber (Vulcanizable Elastomers)
2823	Cellulosic Man-Made Fibers
2824	Synthetic Organic Fibers, Except Cellulosic
2833	Medicinal Chemicals and Botanical Products
2834	Pharmaceutical Preparations
2861	Gum and Wood Chemicals
2865	Cyclic (Coal Tar) Crudes, and Cyclic Intermediates, Dyes, and Organic Pigments
2869	Industrial Organic Chemicals, Not Elsewhere Classified
2879	Pesticides and Agricultural Chemicals, Not Elsewhere Classified
2892	Explosives
2893	Printing Ink
2899	Chemicals And Chemical Preparations, Not Elsewhere Classified
3332	Primary Smelting and Refining of Lead
3339	Primary Smelting and Refining of Nonferrous Metals, Not Elsewhere Classified
3341	Secondary Smelting of Nonferrous Metals
3471	Electroplating, Plating, Polishing, Anodizing and Coloring

This selection was subjective, using our knowledge and experience with these industries. It may be helpful to give examples of our reasoning in eliminating groups:

(1) Group 2812, alkalies and chlorine, gives rise to very few chemicals and these are eaily "neutralized," thus 2812 was eliminated from the list.

(2) Group 2813, industrial gases, was eliminated as causing primarily air pollution rather than water pollution.

(3) Groups 2841, 2842, 2843, 2844 are soaps and toilet preparations which are relatively non-toxic.

(4) Groups 2873, 2874, and 2875 are fertilizers and are considered to be relatively non-toxic.

(5) Group 2895, carbon black, was eliminated because of its relatively limited biological activity.

In the case of Class 33, primary metals, most of the subgroups could be eliminated since they involve the manufacture of relatively non-toxic metals, such as iron and aluminum. Three subgroups were selected, to include those activities involving the more toxic metals such as lead, cadmium, and selenium.

The one additional classification—electroplating, SIC 3471—was included because it was identified by EPA as the third most hazardous waste generating industry and has been receiving considerable attention from EPA as a problem industry.

The list of hazardous industries used in our subsequent study is presented in Table 7-6.

Finding the Toxic Discharger

Having decided what industries in New Jersey we will focus on, we are ready to start the search for individual plants to look at. Since we are considering an entire highly industrialized state, the number of plants even in the limited group of selected industries is large. So again we will limit our search by (1) grouping the plants according to the river basin in New Jersey into which they discharge, (2) determining which basin has the most dischargers in our toxic industry categories, and (3) concentrating on that river basin. In other words, we will look for the river with the highest number of potential toxic dischargers. This approach makes sense, because in a general way, the more toxic dischargers, the greater the danger of health and environmental damage from the river.

Let Your Fingers Do the Walking

One way of finding plants sending wastewater into a river is to walk along that river looking for signs of water coming into the river from a pipe. When such a source is found, it is then necessary to trace the pipe to find the plant from which it comes. People, generally volunteers concerned about pollution in "their" river, do just this, they call themselves "stream walkers." And they can seve a very useful function.

However, for a study the magnitude of ours, in which all the rivers in New Jersey are being surveyed, the effort required would be overwhelming. Fortunately, the Federal Water Pollution Control Act, through its permit system combined with the magic of computer science, "lets your fingers do the walking."

Using the NPDES Permit System

The Federal Water Pollution Control Act Amendments of 1972, now the Clean Water Act, established a permit system whereby all industries and municipalities discharging wastewater into a navigable waterway must apply for and obtain a permit to do so. So, for the first time, there is a list of *all* legal dischargers.

What is more, a record of all permits is maintained by one central authority—the U.S. Environmental Protection Agency (EPA). Information on all permits is entered into a computer and is retrievable at the incredible speed of operation of a computer. Information contained in the computer is available to the public through the Freedom of Information Act.

We will go through the process of using the computer system to answer our question: "Which river basin in New Jersey has the highest number of potential toxic dischargers?"

The first thing we must know is the kinds of data stored in the computer.

The following information is available for every permit (Table 7-7).

The first column in this Table is the NPDES permit number, preceded by an abbreviation for the state in which the discharger operates—in this case, NJ for New Jersey. When a computer print-out is being requested, the state or states desired can be named, and the print-out will then contain only facilities in those states.

Table 7-7

Computer Information on NPDES Permits

NPDES permit number
Facility Name (Name of Discharger)
(Name is Available either by Short Form,
or in Long Form [complete address])
State in Which Facility is Located
City in Which Facility is Located
County in Which Facility is Located
Issue Date of Permit
Expiration Date of Permit
Whether Facility is a Major Discharger
as judged by volume and concentration of discharge
River Basin by Code Number
River Basin, Descriptive Name
SIC Code
Type Owner (Public or Private)

A typical computer print-out page is shown as Table 7-8. All print-outs must have and will have an NPDES permit column. The other columns are optional. Only those requested will appear. The limit on the number of columns in a printout is fixed by the width of the page.

The next column, facility, is the name of the discharger. For the print-out in this Table, the "short name" was specified. If the "long name" is specified, each entry will have two lines, the second line containing the facility address.

The next two columns give the city and county in which the facility discharges.

The "major industry" column prints a letter "M" if the facility is classified by EPA as a major discharger. This classification is made on the basis of volume and quality of the discharge.

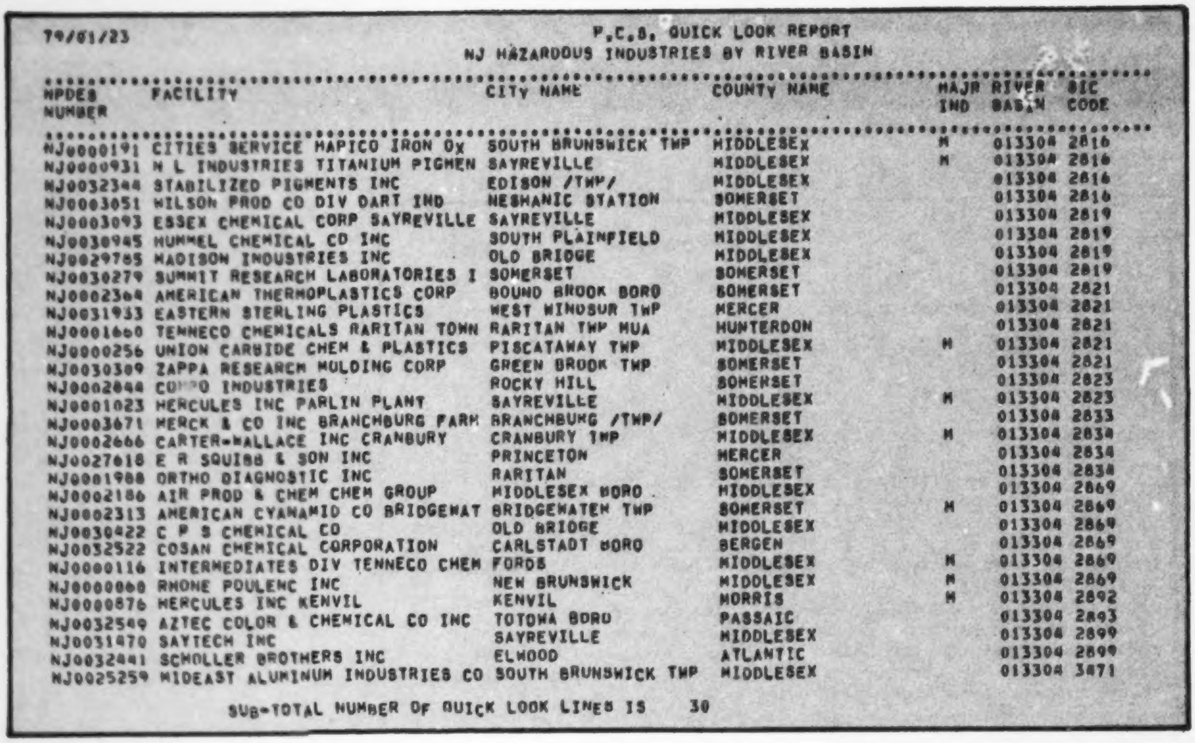
The river basins desired in the print-out are specified by either two, four, or six digits. A listing of river basins and their corresponding two- and four-digit codes is available from EPA on request. Part of the first page of this listing appears in Table 7-9. This page includes the river basins in New Jersey.

EPA is divided geographically into 10 regions. Region II consists of New York, New Jersey, the Virgin Islands, and Puerto Rico. The amount of information available for different regions differs. Region II has subclassified all their rivers into six-digit codes. Part of one page of the code appears in Table 7-10.

On the print-out (Table 7-8) we are discussing the last column which lists the SIC code describing the activity of the discharger. Either two-digit or four-digit SIC codes may be specified. If the facility has activities under more than one SIC code, the computer has it stored under only one code—a shortcoming in the system.

As noted, other columns are available for print-out—issue date of permit, expiration date of permit, river basin by descriptive name, and whether the owner of the facility is public or private. The person requesting a print-out can specify which columns are wanted, provided they will all fit on one line. The NPDES number must be one of those included.

Table 7-8



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79/01/23                                        P.C.S. QUICK LOOK REPORT
                                          NJ HAZARDOUS INDUSTRIES BY RIVER BASIN

**************************************************************************************************
NPDES     FACILITY                           CITY NAME              COUNTY NAME              MAJR RIVER  SIC
NUMBER                                                                                       IND  BASIN  CODE
**************************************************************************************************
NJ0000191 CITIES SERVICE MAPICO IRON OX   SOUTH BRUNSWICK TWP  MIDDLESEX                M    013304 2816
NJ0000931 N L INDUSTRIES TITANIUM PIGMEN  SAYREVILLE           MIDDLESEX                M    013304 2816
NJ0032344 STABILIZED PIGMENTS INC         EDISON /TWP/         MIDDLESEX                     013304 2816
NJ0003051 WILSON PROD CO DIV DART IND     NESHANIC STATION     SOMERSET                      013304 2816
NJ0003093 ESSEX CHEMICAL CORP SAYREVILLE  SAYREVILLE           MIDDLESEX                     013304 2819
NJ0030945 HUMMEL CHEMICAL CO INC          SOUTH PLAINFIELD     MIDDLESEX                     013304 2819
NJ0029785 MADISON INDUSTRIES INC          OLD BRIDGE           MIDDLESEX                     013304 2819
NJ0030279 SUMMIT RESEARCH LABORATORIES I  SOMERSET             SOMERSET                      013304 2819
NJ0002364 AMERICAN THERMOPLASTICS CORP    BOUND BROOK BORO     SOMERSET                      013304 2821
NJ0031933 EASTERN STERLING PLASTICS       WEST WINDSUR TWP     MERCER                        013304 2821
NJ0001660 TENNECO CHEMICALS RARITAN TOWN  RARITAN TWP MUA      HUNTERDON                     013304 2821
NJ0000256 UNION CARBIDE CHEM & PLASTICS   PISCATAWAY TWP       MIDDLESEX                M    013304 2821
NJ0030309 ZAPPA RESEARCH MOLDING CORP     GREEN BROOK TWP      SOMERSET                      013304 2821
NJ0002844 COMPO INDUSTRIES                ROCKY HILL           SOMERSET                      013304 2823
NJ0001023 HERCULES INC PARLIN PLANT       SAYREVILLE           MIDDLESEX                M    013304 2823
NJ0003671 MERCK & CO INC BRANCHBURG FARM  BRANCHBURG /TWP/     SOMERSET                      013304 2833
NJ0002666 CARTER-WALLACE INC CRANBURY     CRANBURY TWP         MIDDLESEX                M    013304 2834
NJ0027618 E R SQUIBB & SON INC            PRINCETON            MERCER                        013304 2834
NJ0001988 ORTHO DIAGNOSTIC INC            RARITAN              SOMERSET                      013304 2834
NJ0002186 AIR PROD & CHEM CHEM GROUP      MIDDLESEX BORO       MIDDLESEX                     013304 2869
NJ0002313 AMERICAN CYANAMID CO BRIDGEWAT  BRIDGEWATER TWP      SOMERSET                 M    013304 2869
NJ0030422 C P S CHEMICAL CO               OLD BRIDGE           MIDDLESEX                     013304 2869
NJ0032522 COSAN CHEMICAL CORPORATION      CARLSTADT BORO       BERGEN                        013304 2869
NJ0000116 INTERMEDIATES DIV TENNECO CHEM  FORDS                MIDDLESEX                M    013304 2869
NJ0000060 RHONE POULENC INC               NEW BRUNSWICK        MIDDLESEX                M    013304 2869
NJ0000876 HERCULES INC KENVIL             KENVIL               MORRIS                   M    013304 2892
NJ0032549 AZTEC COLOR & CHEMICAL CO INC   TOTOWA BORO          PASSAIC                       013304 2893
NJ0031470 SAYTECH INC                     SAYREVILLE           MIDDLESEX                     013304 2899
NJ0032441 SCHOLLER BROTHERS INC           ELWOOD               ATLANTIC                      013304 2899
NJ0025259 MIDEAST ALUMINUM INDUSTRIES CO  SOUTH BRUNSWICK TWP  MIDDLESEX                     013304 3871

                  SUB-TOTAL NUMBER OF QUICK LOOK LINES IS      30
```

Table 7-9

EPA, River Basin Codes

01	NE	NORTHEAST
	01	QUINNIPIAC RIVER & WESTERN CONN COASTAL
	02	HOUSATONIC RIVER
	03	PAWCATUCK RIVER & EASTERN CONN COASTAL
		•
		•
		•
	31	UPPER HUDSON RIVER
	32	MIDDLE HUDSON RIVER
	33	LOWER HUDSON - NEW YORK METROPOLITAN AREA
	34	NEW JERSEY COAST
	35	LAKE ERIE SHORE & MINOR TRIBUTARIES
		•
		•
		•
02	NA	NORTH ATLANTIC
	03	DELAWARE RIVER - ZONE 1
	04	DELAWARE RIVER - LEHIGH
	05	DELAWARE RIVER - SCHUYLKILL
		•
		•
		•

Now that we know the kinds of data available in the computer, we are ready to specify the print-out to request from EPA. The purpose of our print-out is to determine the river basin with the greatest number of dischargers in the New Jersey hazardous industries we have selected. The following is a sample letter:

Your address
City, State, Zip Code
Date

Freedom of Information Officer
A-101
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Freedom of Information Officer:

Under the provisions of the Freedom of Information Act, 5 U.S.C. 552, I am requesting access to a computer print-out which will contain all the facilities in New Jersey which discharge into any river basin and which fall within the SIC codes *(list here the four-digit SIC codes from industries you have identified as hazardous—our list is in Table 7-3, p. 112).*
As a minimum, the print-out should include: NPDES number (restricted to *(name of your state))* , facility name (short form), river basin (6-digit SIC code), SIC code (restricted to those listed above). In addition, I would like it to include *(in our case, the city and county of the facility and the major industry classification).* Please print the computer print-out with pages broken as to river basin.

If there are any fees for searching for, or copying, the records I have requested, please inform me before you fill the request. (Or. . . please supply the records without informing me if the fees do not exceed $________).

I am requesting this information as a member of a group of concerned citizens *(name of organization if you represent one)* who are trying to identify the industries in *(area or state)* which are major sources of toxic pollutants in wastewater. As you know, the Act permits you to reduce or waive fees when the release of the information is considered as "primarily benefiting the public." I believe that this request fits that category and I therefore ask that you waive any fees.

I would appreciate your handling this request as quickly as possible and look forward to hearing from you within 10 days, as the law stipulates.

Sincerely,

(Your Name)

Table 7-8, a typical computer print-out page, has a broken-page format (as requested in the letter). You will note that at the bottom of the page it states, in computer jargon, that there are 30 facilities listed. In other words, there are 30 facilities in the SIC codes specified which discharge to river basin 013304.

The total print-out contained 144 facilities distributed among 31 river basins. The six river basins in New Jersey with the greatest number of facilities are:

Table 7-10

EPA, Region II, River Codes

		*
		*
	14	POCSTAN KILL
	15	MIDDLE HUDSON RIVER - MAIN STEM ONLY FROM BEAR MOUNTAIN BRIDGE TO THE TROY LOCK
	16	OTHER DRAINAGES IN THE MIDDLE HUDSON RIVER MINOR BASIN
0133		**LOWER HUDSON RIVER - NEW YORK METROPOLITAN AREA MINOR BASIN**
	01	RARITAN BAY, SANDY HOOK BAY - BAY ONLY
	02	NAVESINK RIVER (SHREWSBURY RIVER)
	03	OTHER DRAINAGES TO RARITAN & SANDY HOOK BAYS
	04	RARITAN RIVER (MILLSTONE RIVER, NESHANIC RIVER, DELAWARE-RARITAN CANAL)
	05	ARTHUR KILL
	06	RAHWAY RIVER
	07	ELIZABETH RIVER
	08	NEWARK BAY
	09	PASSAIC RIVER (POMPION, RAMAPO, PEQUANNOCK, ROCKAWAY, & WHIPPANY RIVERS)
	10	HACKENSACK RIVER
		*
		*

River Basin			
Code	**Name**	**Number of Facilities**	**Number of Major Facilities**
013304	**Raritan**	30	9
013309	**Passaic**	29	8
013310	**Hackensack**	16	7
013305	**Arthur Kill**	10	5
020708	**Delaware**	6	5
013308	**Newark Bay**	6	2

The Raritan River, then, is the river basin with the greatest number of New Jersey industrial dischargers in the hazardous industry group.

Further study was accordingly confined to the Raritan River basin.

The Raritan River Basin

The Raritan River basin drains some 1105 square miles in north-central New Jersey. Its location in the state is shown in the insert to Figure 7-1. It is the second largest river basin in New Jersey. Major tributaries include the North Branch Raritan River, South Branch Raritan River, Millstone River, Green Brook and South River. Below Fieldville Dam, which is about 14 miles above the river's mouth at Raritan Bay (below Perth Amboy), the river is tidal, so that the river is brackish and not suitable as a source for drinking water.

The lower Raritan includes all of Middlesex County and parts of Union and Somerset Counties. This is an area of principal concern. The lower Raritan basin (between Manville and Perth Amboy) is highly industrialized. The waters of the lower Raritan are used mainly as a source of industrial water and for the disposal of municipal and industrial wastewater. Limited portions are used for recreational and agricultural purposes.

Pollution of the lower Raritan would be even more severe if not for the fact that over 60 percent of total wastewater discharges from facilities on the lower Raritan are going into tidal waters below New Brunswick, most of that being into the Raritan Bay, beyond Perth Amboy.

Middlesex County Sewerage Authority (MCSA), a very large publicly owned treatment works (POTW), is a major factor in disposing of industrial discharges from plants in the lower basin. MCSA receives wastewater from over 70 industrial plants, some of them presumably containing substantial quantities of toxic substances. MCSA treats these wastewaters by conventional methods and discharges the treated water into Raritan Bay. It may reasonably be assumed that substantial quantities of toxic substances are present in this discharge. MCSA receives little or no information from its contributing plants on the presence of toxic substances. Use of MCSA by an industrial plant shifts the responsibility of discharge of toxic chemicals from the plant to the Authority.

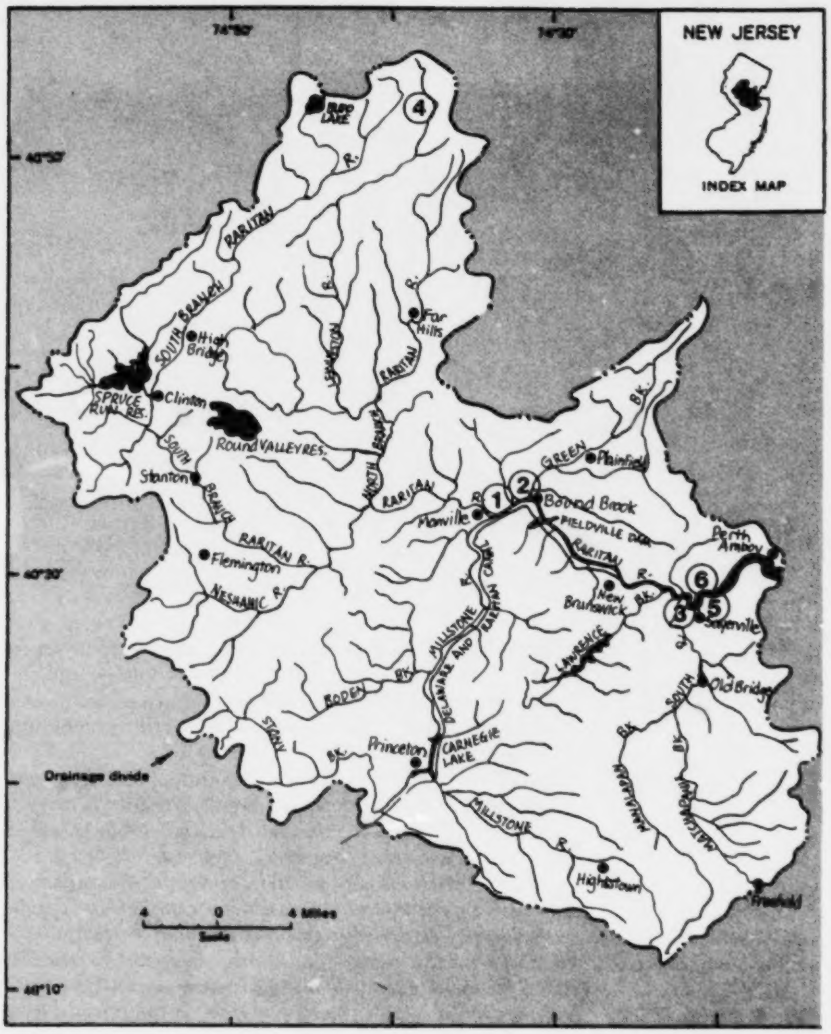
Later in this discussion of the New Jersey study, six plants are selected for study and evaluation of potential risk from toxic substances. Figure 7-1 shows the approximate location of these plants. Five of the plants are in the lower basin, two in the Boundbrook area, and three near Sayreville. The sixth plant, Hercules, discharges into the Black River, a northern tributary of the upper Raritan, where industrialization is less intense and the river receives less pollutants and water quality is relatively good. Agricultural runoff is relatively more significant in this area.

Direct and Indirect Dischargers

The procedure just described gives a list restricted to industrial plants discharging their own wastewater directly to a navigable stream ("direct dischargers"). Such a list gives only a partial picture of the legal discharge of industrial

Figure 7-1

Map of the Raritan River basin


74°50'
74°30'
40°50'
40°30'
40°10'
NEW JERSEY
INDEX MAP
4
Budd Lake
RARITAN
R.
SOUTH BRANCH
High Bridge
Spruce Run Res.
Clinton
Round Valley Res.
Lamington
R.
Far Hills
RARITAN
NORTH BRANCH
SOUTH
Stanton
BRANCH
RARITAN R.
Flemington
NESHANIC R.
RARITAN
R.
1
2
GREEN
Plainfield
BK.
Bound Brook
Manville
FIELDVILLE DAM
RARITAN
R.
Perth Amboy
6
New Brunswick
3
5
Sayreville
BK.
MILLSTONE
R.
DELAWARE AND RARITAN CANAL
LAWRENCE
Old Bridge
SOUTH
R.
BODEN
BK.
STONY
BK.
Princeton
CARNEGIE LAKE
MANALAPAN
BK.
MATCHAPONIX
BK.
MILLSTONE
R.
Hightstown
Freehold
Drainage divide
4
0
4 Miles
Scale

1=American Cyanamid
2=American Hoechst
3=CPS
4=Hercules
5=Saytech
6=Tenneco

waste into a waterway. Many industrial plants choose to pay a publicly-owned sewage treatment plant to treat their wastes rather than to treat their own. Since such plants do not discharge their wastewater into a navigable stream, *they are not required to have an NPDES pemit*. Information on such a plant will not be included in the computer data just described. Such plants are called "indirect dischargers."

However, so-called "publicly-owned treatment works" (POTW), usually municipally-owned, *are required to have NPDES permits*. Such POTW's, whose industrial activity is sewage treatment, have their own SIC code, 4952.

Such POTW's could have been included in the print-out just decsribed simply by including 4952 as an additional SIC code. But to do so would mix apples and oranges. The print-out as obtained contains only industrial discharges from plants on our selected list of hazardous industries. Inclusion of SIC 4952 plants would introduce *all* households and industrial wastes of any nature. Therefore, POTW's were handled separately, in the following manner.

A request for another print-out was made of EPA in Washington, D.C.:

Your address
City, State, Zip Code
Date

Freedom of Information Officer
A-101
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Freedom of Information Officer:

Under the provisions of the Freedom of Information Act, 5 U.S.C. 552, I am requesting access to a computer print-out which will contain all the wastewater treatment facilities, public and private, in *(name of your state)*, which discharge into the *(name)* River Basin *(number, six-digit, if possible)*. As a minimum, I would like the print-out to give long-form facility names, city, county, major indicator, public or private owner, permit issue date, and expiration date.

If there are any fees for searching for or copying, *(insert remainder of Model Letter 1)*.

Sincerely,

(Your Name)

The print-out contained 39 treatment facilities, 36 of which are publicly-owned. One page of the print-out is reproduced as Table 7-11.

As was already pointed out, the wastewater being treated by these plants may originate from wastes from households, office buildings, and stores as well as from industrial establishments of any nature. The print-out gives no clue as to which, if any, of the POTW's receive wastes from industrial plants on our list of hazardous industries.

Two procedures were used to select such potentially hazardous dischargers.

Regional Industrial Contributors System

The first of these procedures utilizes EPA's Regional Industrial Contributors Sysem (RICS). This is a system used by some of EPA's regional offices. RICS is a list of industries discharging to POTW's, classified by the POTW(s) receiving wastes from the plant. (The same plant may discharge in more than one way: a plant may send its storm water directly into a stream and thus have a permit; it may send its process water—water used in its industrial operations—to a POTW; and it could send its water used for cooling to yet another POTW).

A sample page of a RICS print-out appears as Table 7-12. Since the print-out contains indirect industrial dischargers of all types, the list is extensive, about 1,500 in all for New Jersey.

Each contributor on the RICS list takes up two lines on the print-out. A great deal of information is packed into these two lines, most of which is not relevant to our purposes. We need pay attention only to the name of the contributor (first column, top line), city location (first column, bottom line) and the NPDES number of the receiving POTW (third column, top line). Thus, on our sample page, the first entry is Bricktownship Municipal Utilities Authority, located in Bricktown, N.J., discharging into a POTW with an NPDES number of NJ 26018.

The POTW's in this print-out discharge into various river basins in New Jersey. Our interest is in the Raritan River. While the RICS computer system is not programmed to select those POTW's on the Raritan, the NPDES permit computer system can be used for this purpose. This is done by listing all the NPDES numbers on the RICS print-out and asking the computer to select and print-out those facilities which are on the Raritan.

Use of this procedure disclosed the permit numbers of nine POTW's on the RICS print-out which discharge to the Raritan River and one to Raritan Bay.

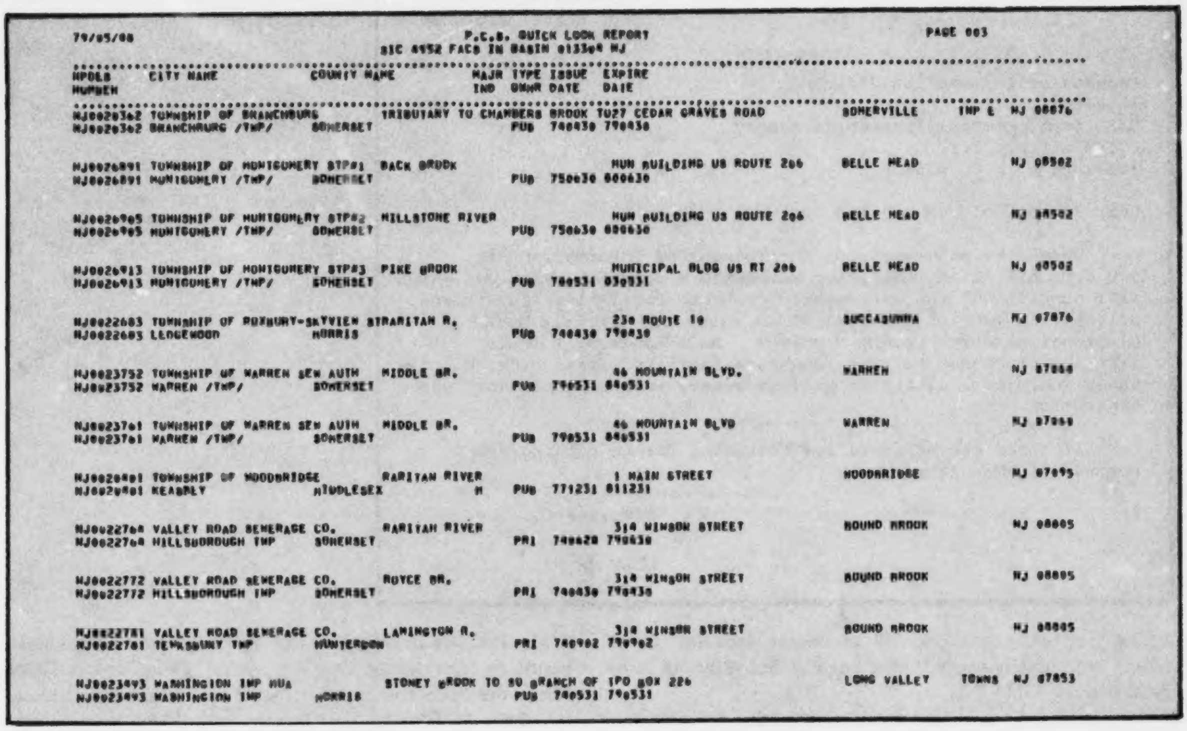
Since the list of contributors on the RICS print-out are grouped by NPDES number of the receiving POTW (third column, top line), selection of the contributors in the RICS print-out which discharge to the Raritan can now be made. This selection was made by listing all contributors discharging to the 10 POTW's on the Raritan.

There are 139 industrial plants in the RICS print-out which send wastewater to a POTW on the Raritan. [Of these, over half (77) contributed to one POTW, Middlesex County Sewerage Authority (MCSA), which discharges to Raritan Bay. This fact was our first indication of the importance of MCSA to the Raritan river water pollution picture. We shall discuss the Middlesex facility in a later section.]

This approach, then, yields 62 industrial plants (139 total, less 77 discharging to Raritan Bay) which indirectly discharge to the Raritan River.

These plants, however, are not confined to the 19 hazardous SIC codes developed earlier. In most cases, the name of the company is sufficient to conclude that the plant does not fall in the hazardous industry category. For example, Advanced Computer Supplies, Dow Jones and Co., Quality Egg and Realty Corp. can be eliminated. For companies whose activities are less clear from the name, checking with reference books, Chambers of Commerce, and other sources can give the information necessary to allow for decision.

Table 7-11



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79/05/08                                   P.C.B. QUICK LOOK REPORT                                PAGE 003
                                       SIC 4952 FACS IN BASIN 01330* NJ
*******************************************************************************************************************
NPDES     CITY NAME              COUNTY NAME          MAJR TYPE ISSUE  EXPIRE
NUMBER                                                 IND  OWNR DATE   DATE
*******************************************************************************************************************
NJ0020362 TOWNSHIP OF BRANCHBURG          TRIBUTARY TO CHAMBERS BROOK TU27 CEDAR GRAVES ROAD       SOMERVILLE      TWP E  NJ 08876
NJ0020362 BRANCHBURG /TWP/      SOMERSET                   PUB  740430 790430


NJ0026891 TOWNSHIP OF MONTGOMERY STP#1  BACK BROOK                 MUN BUILDING US ROUTE 206    BELLE MEAD             NJ 08502
NJ0026891 MONTGOMERY /TWP/      SOMERSET                   PUB  750630 800630


NJ0026905 TOWNSHIP OF MONTGOMERY STP#2  MILLSTONE RIVER            MUN BUILDING US ROUTE 206    BELLE MEAD             NJ 08502
NJ0026905 MONTGOMERY /TWP/      SOMERSET                   PUB  750630 800630


NJ0026913 TOWNSHIP OF MONTGOMERY STP#3  PIKE BROOK                 MUNICIPAL BLDG US RT 206     BELLE MEAD             NJ 08502
NJ0026913 MONTGOMERY /TWP/      SOMERSET                   PUB  780531 030531


NJ0022683 TOWNSHIP OF ROXBURY-SKYVIEW STRARITAN R.                 230 ROUTE 10                 SUCCASUNNA             NJ 07876
NJ0022683 LEDGEWOOD             MORRIS                     PUB  740430 790430


NJ0023752 TOWNSHIP OF WARREN SEW AUTH   MIDDLE BR.                 46 MOUNTAIN BLVD.            WARREN                 NJ 07060
NJ0023752 WARREN /TWP/          SOMERSET                   PUB  790531 840531


NJ0023761 TOWNSHIP OF WARREN SEW AUTH   MIDDLE BR.                 46 MOUNTAIN BLVD             WARREN                 NJ 07060
NJ0023761 WARREN /TWP/          SOMERSET                   PUB  790531 840531


NJ0020001 TOWNSHIP OF WOODBRIDGE        RARITAN RIVER              1 MAIN STREET                WOODBRIDGE             NJ 07095
NJ0020001 KEASBEY               MIDDLESEX             M    PUB  771231 011231

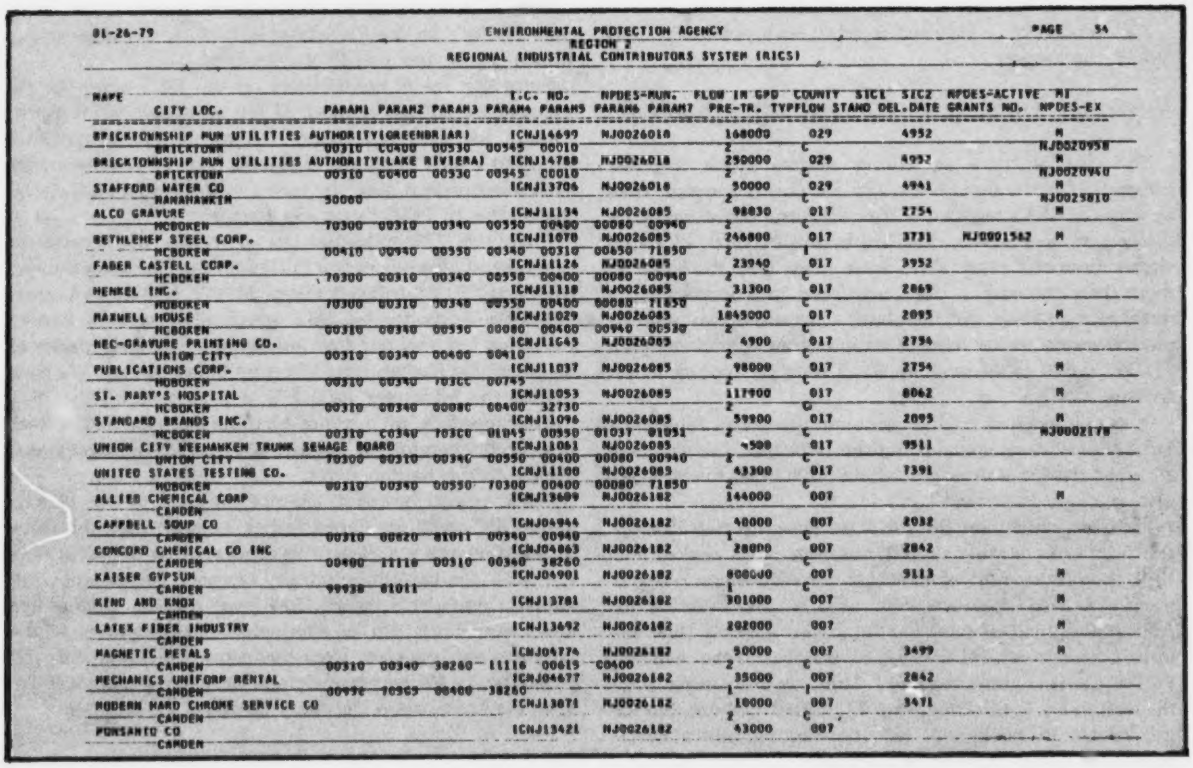

NJ0022764 VALLEY ROAD SEWERAGE CO.      RARITAN RIVER              314 WINSOR STREET            BOUND BROOK            NJ 08805
NJ0022764 HILLSBOROUGH TWP      SOMERSET                   PRI  740628 790630


NJ0022772 VALLEY ROAD SEWERAGE CO.      ROYCE BR.                  314 WINSOR STREET            BOUND BROOK            NJ 08805
NJ0022772 HILLSBOROUGH TWP      SOMERSET                   PRI  740430 790430


NJ0022781 VALLEY ROAD SEWERAGE CO.      LAMINGTON R.               314 WINSOR STREET            BOUND BROOK            NJ 08805
NJ0022781 TEWKSBURY TWP         HUNTERDON                  PRI  740902 790902


NJ0023493 WASHINGTON TWP MUA            STONEY BROOK TO SO BRANCH OF 1PO BOX 226                LONG VALLEY     TOWNS  NJ 07853
NJ0023493 WASHINGTON TWP        MORRIS                     PUB  740531 790531
```

Table 7-12



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01-26-79                                  ENVIRONMENTAL PROTECTION AGENCY                                  PAGE    54
                                                    REGION 2
                                    REGIONAL INDUSTRIAL CONTRIBUTORS SYSTEM (RICS)

NAME                                             T.C. NO.   NPDES-MUN.  FLOW IN GPD  COUNTY  SIC1  SIC2  NPDES-ACTIVE  MI
       CITY LOC.          PARAM1 PARAM2 PARAM3 PARAM4 PARAM5 PARAM6 PARAM7  PRE-TR. TYPFLOW STAND DEL.DATE GRANTS NO.  NPDES-EX
=============================================================================================================================
BRICKTOWNSHIP MUN UTILITIES AUTHORITY(GREENBRIAR)    ICNJ14699   NJ0026018    168000     029         4952               M
       BRICKTOWN          00310  C0400  00530  00945  00010                   Z          C                             NJ0020958
BRICKTOWNSHIP MUN UTILITIES AUTHORITY(LAKE RIVIERA)  ICNJ14788   NJ0026018    250000     029         4952               M
       BRICKTOWN          00310  C0400  00530  00945  C0010                   Z          C                             NJ0020940
STAFFORD WATER CO                                    ICNJ13706   NJ0026018     50000     029         4941               M
       MANAHAWKIN         50000                                               Z          C                             NJ0023810
ALCO GRAVURE                                         ICNJ11134   NJ0026085     98030     017         2754               M
       HOBOKEN            70300  00310  00340  00550  00400  00080  00940     Z          C
BETHLEHEM STEEL CORP.                                ICNJ11070   NJ0026085    246800     017         3731  NJ0001562    M
       HOBOKEN            00410  00940  00550  00340  00310  00650  71850     Z          I
FABER CASTELL CORP.                                  ICNJ11126   NJ0026085     23940     017         3952
       HOBOKEN            70300  00310  00340  00550  00400  00080  00940     Z          C
HENKEL INC.                                          ICNJ11118   NJ0026085     31300     017         2869
       HOBOKEN            70300  00310  00340  00550  00400  00080  71850     Z          C
MAXWELL HOUSE                                        ICNJ11029   NJ0026085   1045000     017         2095               M
       HOBOKEN            00310  00340  00550  00080  00400  00940  00530     Z          C
NEC-GRAVURE PRINTING CO.                             ICNJ11645   NJ0026085      4900     017         2754
       UNION CITY         00310  00340  00400  00410                          Z          C
PUBLICATIONS CORP.                                   ICNJ11037   NJ0026085     98000     017         2754               M
       HOBOKEN            00310  00340  70300  00745                          Z          C
ST. MARY'S HOSPITAL                                  ICNJ11053   NJ0026085    117900     017         8062               M
       HOBOKEN            00310  00340  00080  00400  32730                   Z          G
STANDARD BRANDS INC.                                 ICNJ11096   NJ0026085     59900     017         2095               M
       HOBOKEN            00310  C0340  70300  01045  00550  01037  01051     Z          C                             NJ0002178
UNION CITY WEEHAWKEN TRUNK SEWAGE BOARD              ICNJ11061   NJ0026085      4500     017         9511
       UNION CITY         70300  00310  00340  00550  00400  00080  00940     Z          C
UNITED STATES TESTING CO.                            ICNJ11100   NJ0026085     43300     017         7391
       HOBOKEN            00310  00340  00550  70300  00400  00080  71850     Z          C
ALLIED CHEMICAL CORP                                 ICNJ13609   NJ0026182    144000     007                            M
       CAMDEN
CAMPBELL SOUP CO                                     ICNJ04944   NJ0026182     40000     007         2032
       CAMDEN             00310  00820  01011  00340  00940                   1          C
CONCORD CHEMICAL CO INC                              ICNJ04063   NJ0026182     28000     007         2842
       CAMDEN             00400  11118  00310  00340  38260                              C
KAISER GYPSUM                                        ICNJ04901   NJ0026182    800000     007         5113               M
       CAMDEN             99938  01011                                        1          C
KIND AND KNOX                                        ICNJ13781   NJ0026182    301000     007                            M
       CAMDEN
LATEX FIBER INDUSTRY                                 ICNJ13692   NJ0026182    202000     007                            M
       CAMDEN
MAGNETIC METALS                                      ICNJ04774   NJ0026182     50000     007         3499               M
       CAMDEN             00310  00340  38260  11116  00615  C0400            Z          C
MECHANICS UNIFORM RENTAL                             ICNJ04677   NJ0026182     35000     007         2842
       CAMDEN             00932  70305  00400  38260                          1          I
MODERN HARD CHROME SERVICE CO                        ICNJ13071   NJ0026182     10000     007         3471
       CAMDEN                                                                 Z          C
MONSANTO CO                                          ICNJ13421   NJ0026182     43000     007
       CAMDEN
```

By this procedure, all but 6 of the 62 plants were eliminated from further consideration. Those six are:

Miranol Chemical Company
Tenneco Corporation — Flemington plant
American Smelting and Refining Company
NL Industries
Witco Chemical Company
American Hoechst Company

Tenneco Corporation and NL Industries are on the list of direct dischargers in a hazardous industry. It is evident that these plants are both direct and indirect dischargers.

A telephone call to the South Brunswick Township treatment plant disclosed that the Miranol Chemical Company made baby shampoo. This plant was therefore eliminated. A call to the Somerset-Raritan Valley Sewerage Authority revealed that American Hoechst did fall within our hazardous industries.

Our procedure, then, has added three plants that warrant further study. American Smelting and Refining Company, Witco, and American Hoechst.

Indirect Discharger Contact

An alternate procedure to obtain similar information was also used. This alternative is the only method available if the area being studied does not have a RICS capability. In essence, this procedure seeks the same information as given by RICS, but obtains it from the separate POTW's.

Industrial plants and residential areas convey their wastes to a sewer and then—in a stream of water—to a pond, river, stream, or other body of water. Although conventional sewage treatment eliminates household pollutants, many industrial wastes are not effectively treated.
Credit: EPA DOCUMERICA - John L. Alexandrowicz

The first step is to obtain a list of POTW's in the area of interest, precisely as was done in the RICS procedure. The print-out of 39 treatment facilities has been discussed already (p. 128).

Contact (letter or telephone) is then made with each POTW on the Raritan, asking the treatment facility for a list of all contributors to their facility which fall within the hazardous industries we selected. (A list of these 19 SIC codes is given to each facility.)

In this study, a letter was sent to the 39 facilities. Telephone contact was made with those who did not respond in a reasonable time.

Of the 39 treatment plants, 36 supplied information. Most of these, however, stated either that they received no industrial wastewater or that they received no wastewater from industries in the 19 SIC codes specified.

Hazardous Plants: NPDES Permits

As was shown in Table 7-8, 30 industrial plants in our hazardous industries categories discharge into the Raritan River. Which of these plants present the most serious and threatening toxic substances problems?

As a first step in answering this question, NPDES permits and permit applications for these 30 plants were obtained from the EPA Regional Office having the state in question in its area. New Jersey lies within Region II. See Figure 7-2 for a map of the EPA regional offices. To obtain these documents, a letter should be addressed to the appropriate Regional Office (see Model Letters 1 and 2 as general guides) requesting permits and permit applications for the desired plants, listed by names and NPDES numbers.

You will get back an impressive amount of paper. But finding information in these documents relevant to potential toxic problems is only somewhat better than finding the proverbial needle in a haystack.

Most of the permit consists of what lawyers call "boilerplate"—stereotype legal and technical jargon unvarying from permit to permit decribing the legal obligations of the "permittee"—page after page of it. The only part of a permit of interest in evaluating toxic chemical risk is the section on effluent limitations. A sample of this section of a permit appears as Appendix VII-2-a. In this particular permit, discharge limits are put on suspended solids (undissolved materials of unspecified composition), total organic carbon (total of all organic matter of unspecified composition), temperature (a discharge too cold or too hot can adversely affect organisms living in the river), pH (how acid or alkaline the discharge is), zinc and chromium (two "heavy metals" with some toxicity). Most permits also place a limit on BOD (Biological Oxygen Demand), a measure of how much life-giving oxygen is used up to treat the waste.

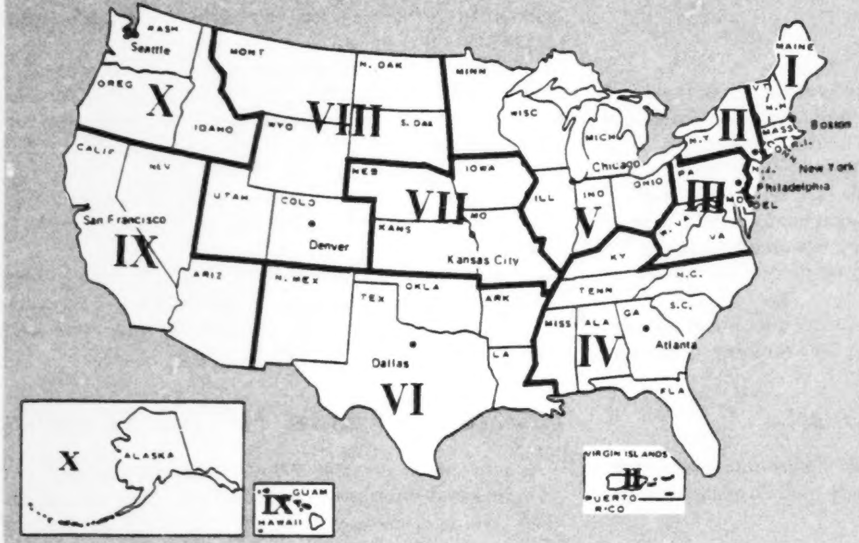
So, except for chromium and zinc, one might suppose there are no toxic substances in the wastewater. Unfortunately, such a conclusion is unwarranted. With minor exceptions, such as heavy metals, a permit gives little indication of the nature of the compounds in the discharge.

Additional information is sometimes found in the permit application submitted by the plant in order to get a permit. Let us examine these applications in some detail.

Figure 7-2

United States Environmental Protection Agency

Regional Offices


WASH
Seattle
OREG
X
IDAHO
MONT
WYO
VIII
N. DAK
S. DAK
MINN
WISC
MICH
MAINE
I
VT
N.H.
MASS
Boston
CONN
R.I.
N.Y.
II
N.J.
New York
Philadelphia
PA
III
MD
DEL
CALIF
NEV
UTAH
COLO
Denver
NEB
VII
KANS
IOWA
MO
Kansas City
ILL
Chicago
IND
OHIO
V
W. VA
VA
KY
San Francisco
IX
ARIZ
N. MEX
OKLA
TEX
Dallas
VI
ARK
LA
TENN
N.C.
S.C.
MISS
ALA
GA
Atlanta
IV
FLA
X
ALASKA
IX
GUAM
HAWAII
VIRGIN ISLANDS
II
PUERTO RICO

REGIONS

Alabama	IV	Indiana	V	Nevada	IX	Tennessee	IV
Alaska	X	Iowa	VII	New Hampshire	I	Texas	VI
Arizona	IX	Kansas	VII	New Jersey	II	Utah	VIII
Arkansas	VI	Kentucky	IV	New Mexico	VI	Vermont	I
California	IX	Louisiana	VI	New York	II	Virginia	III
Colorado	VIII	Maine	I	North Carolina	IV	Washington	X
Connecticut	I	Maryland	III	North Dakota	VIII	West Virginia	III
Delaware	III	Massachusetts	I	Ohio	V	Wisconsin	V
D.C.	III	Michigan	V	Oklahoma	VI	Wyoming	VIII
Florida	IV	Minnesota	V	Oregon	X	American Samoa	IX
Georgia	IV	Mississippi	IV	Pennsylvania	III	Guam	IX
Hawaii	IX	Missouri	VII	Rhode Island	I	Puerto Rico	II
Idaho	X	Montana	VIII	South Carolina	IV	Virgin Islands	II
Illinois	V	Nebraska	VII	South Dakota	VIII		

There are two types of application forms generally usd by EPA for manufacturing plants. Short Form C consists of two pages; a completed form is shown as Appendix VII-2-b. The only information requested on this form relevant to chemicals possibly present in the wastewater are items 5, 6, 7, 8, 10, 13 and 14. Of these items, 7, 8, 10 and 13 relate only to amount of discharge and where it goes. Item 5 requests either the principal product or principal raw material made or used by the plant and item 6 requests the principal process. As shown in the example in the Appendix, responses typically are very general and do not help much in uncovering what chemicals are involved in the manufacturing process. Item 14 gives the name of the river receiving the discharge. In the Appendix example, the Passaic River is named by the applicant; EPA classified the plant as a discharger to the Raritan. Item 14 is the most relevant to toxic substances, asking whether the discharge may contain ammonia, cyanide, phenols, oil and grease, residual chlorine or any of 10 metals. However, if the response is "yes," there is no follow-up question on the application as to which of these may be in the discharge. We noted that some companies checked neither "yes" or "no," yet they were granted permits.

The Standard Application Form requests considerably more information than the Short Form. Much of this additional information is not relevant to toxic substance problems; we will disregard these portions of the form. Pages 1, 2 and 3 of Section II (Appendix VII-2-c), request the precise location of the point of discharge (items 6 and 7), a description of the activity of the firm including its SIC codes, raw materials, and products (items 13 and 14), and waste abatement practices (item 15). However, responses are usually not especially helpful for our purposes. Manufacturing activities, principal products, and raw materials are described in general, broad terms or not answered at all. Specific responses are often designated as confidential by the applicant. As a result, EPA will not communicate the information to anyone outside the agency.

The most useful information is contained in the response to item 16. The presense of toxic heavy metals, cyanide, phenols, chlorinated hydrocarbons, and pesticides in the wastewater certainly is of significance in possible risk to human health and the environment. If chlorinated hydrocarbons or pesticides are present, an applicant is asked to name specific substances, compounds, and/or elements present.

The permits and permit applications for the 30 plants discharging into the Raritan were reviewed to determine which plants should be selected for further study. In such a selection process, it is helpful to decide on objectives and scope of the study. One might be looking only for plants discharging close to one's hometown, or for the one plant with the greatest amount of heavy metal discharge, or for three plants most likely to be discharging toxic substances with chronic effects.

The objective of our New Jersey case study is to illustrate how the severity of risks from toxic substance discharges can be estimated and ranked, so that attention can be focused on those plants presenting the greatest risk.

In order to keep this study within manageable size, it was decided that the discharges from about half a dozen plants would be addressed. Further, since this study is designed as a learning exercise, some diversity in the kinds of plants studied (e.g., size, pretreatment, direct or indirect discharger) would be sought.

From a review of the data in the permits and permit applications the following plants were chosen in a "first cut":

Plant	**Basis for Selection, from NPDES Permit and Applications**
1. American Cyanamid Bound Brook, N.J.	Very large, diversified chemical manufacturer; 800 chemical operations in the manufacture of 1000 synthetic organic chemicals including dyes and textile chemicals, organic pigments, rubber chemicals, pharmaceuticals, phenols, and intermediate chemicals. Many heavy metals present in discharge.
2. Saytech, Inc.	Small chemical manufacturer, principal product decabromobiphenyl oxide (related to PCB). Effluent limitation on polybrominated biphenyls.
3. Tenneco, Fords, N.J.	Effluent limitations on chlorinated hydrocarbons. Phenols and cyanides in discharge. Manufacturer of chemical intermediates.
4. Rhodia	Manufacturer of fine organic chemicals; relatively high priced, low-volume chemicals (often less is known of toxicity of such chemicals than for high-volume chemicals).
5. Union Carbide Bound Brook, N.J.	Produce formaldehyde and phenolic resins. Phenols in discharge.
6. Hercules Kenvil, N.J.	Large manufacturer of smokeless powder. Chlorine in discharge.
7. C.P.S. Chemical Company	Small manufacturer of organic esters by transesterification.

Further information on the products produced in these facilities is available from various reference works listed in the bibliography, especially the Chemical Economic Handbook, Directory of Chemical Producers, Moody's Industrial Manual, and Securities and Exchange Commission 10K Reports. In addition, information was obtained by discussion of these plants with EPA engineers who participated in the writing of permits for these companies.

On the basis of this additional information, it was decided to eliminate two of the plants, Rhodia and Union Carbide, from further study. Rhodia was eliminated because its discharge into the Raritan was confined to steam used for plant boilers. Waste process waters, which could contain toxic substances used in or resulting from chemical manufacturing operations, are sent to a municipal waste treatment system, ending up in Raritan Bay after treatment by Middlesex

County Sewerage Authority (MCSA). (This same situation applies to many plants along the Raritan.) In addition, Rhodia's products are flavor and fragrance chemicals (brazinol, coumarin, isoborneol, isobornyl acetate, p-isopropyl-α-methylhydrocinnamaldehyde, α-terpinyl acetate, virdinal) and medicinals (dimetridazol glycol monosalicylate, metronidazole, salicylaldehyde). These products are sufficiently expensive that for economic reasons, there should be a minimal amount in the effluent. Further, none of these substances is on a list of toxic pollutants.

Union Carbide was eliminated because it discharges only infrequent storm water overflow into the Raritan. All the rest of its wastewater discharges directly into a trunkline of the MCSA treatment plant.

To illustrate the extent to which MCSA dominates the sewage treatment problem along the Raritan, three of the remaining five plants send their process water to MCSA. Only American Cyanamid and Hercules are direct dischargers. Nevertheless, further study was made not only of these two direct dischargers but also of the three indirect dischargers—Tenneco, Saytech, and C.P.S.—since there are important points to be learned from studying these plants.

Of the positive responses, the following indirect dischargers were in the specified SIC codes:

American Hoechst
Ortho Pharmaceutical
Sage Laboratories
Stauffer Chemical Co.
Tenneco
Witco

This procedure, then, includes the two plants, American Hoechst and Witco, resulting from the study of the RICS system.

Ortho Pharmaceutical was not included in the RICS list.

Sage Laboratories is a small company which packages products.

Stauffer Chemical Co. sends its wastewater to a POTW which in turn transmits the wastewater to MCSA.

Tenneco is already on our list of direct dischargers for further study.

Both procedures, then, point to American Hoechst and Witco. Reference books revealed that Witco manufactures principally stearates and detergents. Since these classes of compounds are not highly toxic, the decision was made to select for study American Hoechst, which makes a diversified list of organic chemicals, dyes and pigments, plastics, and pharmaceuticals.

Our list of plants for study, then includes:

American Cyanamid
American Hoechst
C.P.S. Chemical Company
Hercules, Kenvil, N.J.
Saytech, Inc.
Tenneco, Fords, N.J.

In view of the significant role it plays in disposing of wastewater from industrial plants in the Raritan River basin, attention will also be given to MCSA. Please note, however, that MCSA discharges not into the Raritan River but into Raritan Bay.

Chapter VIII Summary

Evaluating Relative Risk: Procedure and Limitations

Industrial plants pinpointed in Chapter VII as most likely to pose risks to health and the environment are assessed in a six-step process:

(1) A list is developed of compounds produced in each plant;

(2) Lists of toxic substances and literature data on toxicity are used to identify toxic compounds made by each plant;

(3) Data available on effluent volume are used to estimate the amount of each toxic compound discharged;

(4) Available data are used to estimate environmental exposure of the toxic compounds made by each plant;

(5) Available data are used to estimate the relative toxicity of each toxic compound under study;

(6) Based on the above information, each plant is ranked as to potential hazard posed to health and the environment.

CHAPTER VIII

Evaluating Relative Risk: Procedure And Limitations

Our next task is to estimate the relative severity of risk from toxic substance discharges in wastewater from the plants identified for further study in Chapter VII. Chart A schematically describes the procedure used to accomplish this objective. This procedure is followed for each company; rankings are made at the end of the procedure.

The left-hand side of the chart lists the steps to determine the toxic chemicals discharged by the plant and the potential nature and severity of the toxic effects of these chemicals taking into account both toxicity and exposure factors. Exposure considerations are detailed in Chart B.

The right-hand side of the chart outlines the procedure for estimating the relative amounts of toxic chemicals being discharged by the plant.

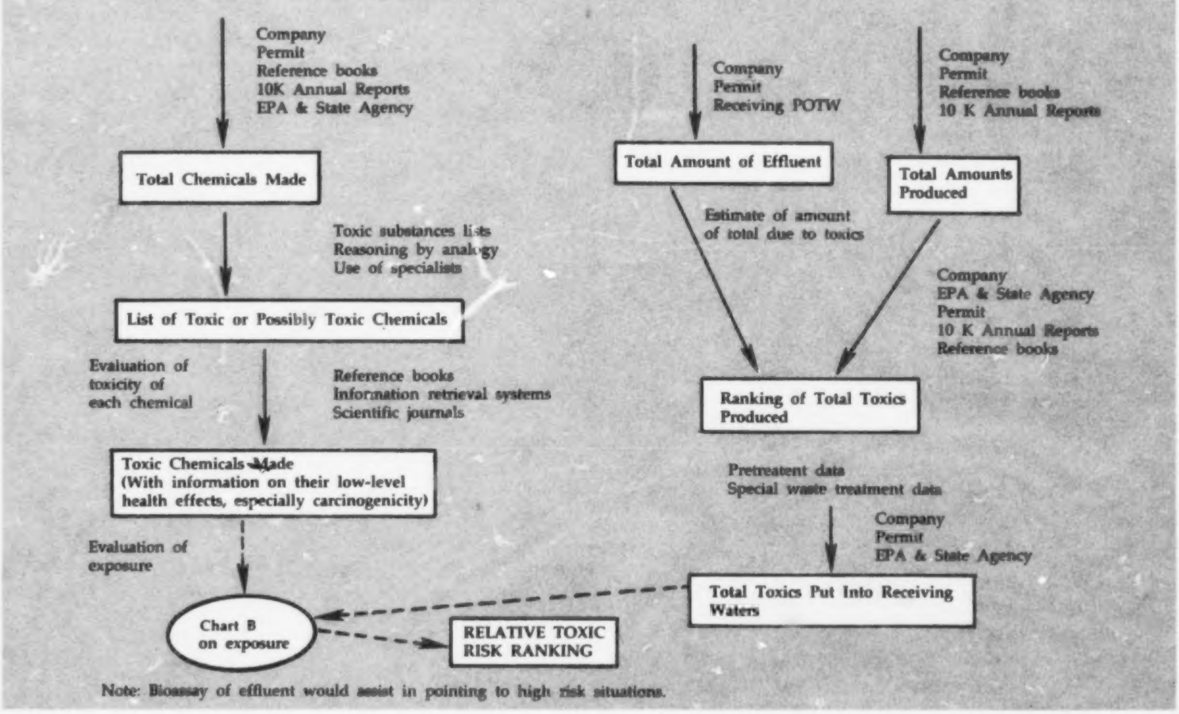
The relative toxic risk ranking of a plant is derived from a consideration of both sides of the chart—that is, from both the potential toxic effects of the chemicals and the amount of the chemicals discharged.

Alongside the arrows in Chart A are the sources from which the data in that procedural step are derived. Where it helps clarify the process, a short description of the step is given.

Lack of data (either because it does not exist or because it was considered confidential by the company and could not be obtained) imposes a serious limitation on the precision of the process. These limitations will become apparent as we proceed with the details.

Chart A

Ranking Toxic Risk for a Company's Wastewater Discharge


Company
Permit
Reference books
10K Annual Reports
EPA & State Agency
Total Chemicals Made
Toxic substances lists
Reasoning by analogy
Use of specialists
List of Toxic or Possibly Toxic Chemicals
Evaluation of toxicity of each chemical
Reference books
Information retrieval systems
Scientific journals
Toxic Chemicals Made (With information on their low-level health effects, especially carcinogenicity)
Evaluation of exposure
Chart B on exposure
RELATIVE TOXIC RISK RANKING
Company
Permit
Receiving POTW
Total Amount of Effluent
Company
Permit
Reference books
10 K Annual Reports
Total Amounts Produced
Estimate of amount of total due to toxics
Company
EPA & State Agency
Permit
10 K Annual Reports
Reference books
Ranking of Total Toxics Produced
Pretreatment data
Special waste treatment data
Company
Permit
EPA & State Agency
Total Toxics Put Into Receiving Waters

Note: Bioassay of effluent would assist in pointing to high risk situations.

Chart B

Exposure Factors

1. TRANSPORT AND ENVIRONMENTAL FATE
  a. Water Solubility
  b. Vapor Pressure
  c. Density
  d. Particle Size (Undissolved Solids)
  e. Adsorption to Particles

2. PERSISTENCE
  a. Hydrolysis Rate: Water Stability
  b. Photolysis Rate: Light Stability
  c. Oxidation-Reduction Potential
  d. Biochemical Oxygen Demand: Biological Stability

3. BIOACCUMULATION TENDENCY
  a. Partition Coefficient
  b. Organic Solvent Solubility
  c. Water Solubility

Knowledge of these limitations has a positive as well as a limiting aspect. Knowing what limitations exist, citizens can take action to release known information and initiate the gathering of unknown information by companies and government agencies.

The ideal procedure would be to obtain a complete analysis for toxic chemicals, chemical by chemical, with the discharged amounts of each, for the wastewater from a plant. With few exceptions, such data do not exist. An indirect procedure is therefore necessary. Chart A was developed to use existing available data to reach the desired objective.

Discharge data are usually available for metals, since metal analysis technology is relatively simple. Sometimes there are data on pesticides, phenols, and chlorinated hydrocarbons, where limits have been placed by EPA on their discharge. However, where such limitations have been imposed, they presumably are set at a level which will not cause environmental risk. Unless discharge limitations are being violated, and they may well be, the regulated chemicals should not be a risk factor. (However, pesticide limitations are especially controversial and may be too lenient.) If you run into a questionable situation in evaluating risks in your area, your regional EPA office will supply you compliance data on request. You can then judge whether the situation calls for your intervention.

Chemicals Made

Let us now go through this priority-setting procedure step-by-step.

First, we want a list of all chemicals made by the plant. A basic assumption is involved: that all compounds made by a company will be present in the wastewater. This assumption is probably valid, but suffers from two limitations. First, the amount of the product in the wastewater will not be proportional to the amount of product made. Second, chemicals used in processing, and chemical by-products, will also be in the wastewater. These may be as toxic or even more toxic than the products. Unfortunately, data on amounts of product, process ingredients and by-products in wastewater require generally unavailable data. Such data are sorely needed to protect public health and the environment. (Procedures can and should be developed to make intelligent estimates of some of the reactants and by-products.)

In view of the foregoing, our methodology assumes that risk arises solely from products in the wastewater, and that the amounts of these are roughly proportional to the amounts manufactured.

Difficulty was encountered obtaining a list of the chemicals made at a plant. Products made are usually products sold and would not be expected to be a secret (at least to the company's customers). Yet, of the six companies approached only one (Saytech, Inc.) freely turned over a complete list. Of the other companies, two supplied partial information and three refused to give any information whatsoever. In one of the latter cases, EPA had a list supplied them by the company, but we could not obtain the list, since the company had designated the information as confidential.

Limited information on products was sometimes available in permits and permit applications. In one instance (Tenneco) where there appeared to be significant information, checking with the company revealed that the permit data was obsolete. EPA was able to supply us with an up-to-date list.

Lists of chemicals made by individual plants are often found either in publicly-available reference books (see, bibliography), annual corporate reports, or 10-K reports made annually to the Securities and Exchange Commission by certain publicly-held corporations. Such lists are not necessarily accurate, since their source is the company. Companies sometimes list compounds they could make if they found a customer, in the hope of finding a customer. They may, on the other hand—for various reasons—omit compounds they do make.

The inventory recently completed by EPA of all chemicals commercially manufactured in the U.S. could turn out to be an additional useful source of product information. However, many companies have specified the data they supplied as confidential, so that they will be inaccessible outside EPA.

Table 8-1 lists, as accurately and completely as our data sources permitted, all compounds made by each of the plants identified for further study.

Possibly Toxic Compounds

The next step is to narrow down this total list to a list of toxic or possibly toxic substances. By toxic substances, we mean chemicals which are on a government list of toxic substances. By possibly toxic substances we mean compounds chemically analogous to toxic substances or compounds about which more information is needed to make a decision as to toxicity, or compounds which—from data in reference handbooks or in information retrieval systems—evidence significant toxicity.

Table 8-1-a

Chemicals Made By American Cyanamid Company

1. N-Acetylsulfanilyl chloride
2. 1-Aminoanthraquinone
3. 2-Aminoanthraquinone
4. 2-Amino-1-butanol
5. 1-Amino-5-chloroanthraquinone
6. 2-Amino-5-chloro-4-ethylbenzenesulfonic acid
7. 3-Amino-6-chloropyridazine
8. 2-Amino-5-chloro-p-toluenesulfonic acid
9. 4-Amino-3-hydroxy-l-naphthalenesulfonic acid
10. 2-Amino-4-methylpyrimidine
11. 2-Amino-5-methyl-1,3,4-thiadiazole
12. 2-Amino-1,5-naphthalenedisulfonic acid
13. 2-Amino-1-naphthalenesulfonic acid
14. 4-Amino-1-naphthalenesulfonic acid
15. p-[(p-Aminophenyl) azo] benzenesulfonic acid
16. 4-Amino-m-toluenesulfonic acid
17. 4-Amino uracil
18. Aniline
19. Anilinomethanesulfonic acid
20. D,L-Asparagine
21. 7H-Benz (de) anthracen-7-one
22. Benzothiazole
23. o-Benzoylbenzoic acid
24. (4,4′-Bi-7H-benz [de] anthracen)-7,7′-dione
25. 3-Bromo-7H-benz (de) anthracen-7-one
26. 2-tert-Butyl-p-cresol
27. 2-tert-Butyl-4-ethylphenol
28. Carbazole violet
29. 2,4′-Carbonyl dibenzoic acid
30. 1-Chloroanthraquinone
31. 2-Chloroanthraquinone
32. Chloro-7H-benz (de) anthracen-7-one
33. p-Chlorobenzenesulfonamide
34. o-(p-Chlorobenzoyl) benzoic acid
35. 1-Chloro-2-methylanthraquinone
36. 1-Chloro-5-nitroanthraquinone
37. β-Chloropropionitrile
38. 2-Chloropyrazine
39. [(4-Chloro-o-tolyl) thio] acetic acid
40. 4,4′-Diamino-2,2′-biphenyldisulfonic acid
41. 4,4′-Diamino-3,3′-dimethyltriphenylmethane
42. 4,4′-Diamino-2,2′-stilbenedisulfonic acid
43, 4,5′-Dibenzamido-1,1′-iminodianthraquinone
44. 1,5-Dibenzoylnaphthalene
45. Dichlorobenzanthrone
46. 2,3-Dichloropyrazine
47. 2,6-Dichloropyrazine
48. 3,6-Dichloropyridazine
49. α-[(2-Diethylamino) ethyl]-α-phenylcyclohexanemethanol
50. 3-(Diethylamino) propiophenone
51. N,N-Diethylaniline
52. 9,10-Dihydro-9,10-dioxo-1-anthracenesulfonic acid
53. Dilauryl 3,3′-thiodipropionate
54. N,N-Dimethylaniline
55. 2,2′-Dimethyl-1,1-bianthraquinone
56. N,N-Dimethyl-p-nitrosoaniline
57. 4,4′-Dinitrostilbene-2,2′-disulfonic acid
58. Diphenylamine
59. 1,3-Diphenyl-2-thiourea
60. 2,5-Dithiobiurea
61. Dyes
   - Acid dyes
   - Azoic coupling components
   - Basic dyes
   - Direct dyes
   - Disperse dyes
   - Mordant dyes
   - [Phthalocyaninato (2-)] copper
   - Solvent dyes
   - Vat dyes
62. Elastomers
   - Polyacrylates
   - Thermoplastic elastomers
63. N-Ethylaniline
64. p-Ethylphenol
65. Hydrogen
66. N-(Hydroxymethyl) phthalamide
67. N′-(5-Ethyl-1,3,4 thiadiazol-2-yl) sulfanilamide
68. 2-Hydroxy-4-methoxy-5-sulfobenzophenone
69. 3-Hydroxy-2,7-naphthalenedisulfonic acid
70. 7-Hydroxy-1,3-naphthalenedisulfonic acid
71. N-(2-Hydroxy-1-naphthyl) acetamide
72. Hydroxynitroviolanthrone
73. 2-Hydroxy-4-sulfo-1-naphthalenediazonium hydroxide
74. 1,1′-Iminobis (4-aminoanthraquinone)
75. 1,1′-Iminobis (4-benzamidoanthraquinone)
76. 1,1′-Iminobis-4-nitroanthraquinone
77. N-Isopropylaniline
78. Isoviolanthrone
79. Leuco-1,4-diaminoanthraquinone
80. Leuco quinizarin
81. 1-(Methylamino) anthraquinone
82. Medicinal (Pharmaceutical) Chemicals
   - Beta naphthol
   - Diethylcarbomazine citrate
   - Salicylazosulfapyridine
   - Sulfabenzamide
   - Sulfachloropyrazine
   - Sulfadiazine
   - Sulfamerazine
   - Sulfamethazine
   - Sulfamethizole
   - Thiouracil
   - Tridihexethyl chloride
   - Trihexyphenidyl hydrochloride
83. N-Methylaniline
84. 2-Methylanthraquinone
85. N,N′-Methylenebisacrylamide
86. p-(3-Methyl-5-oxo-2-pryazolin-1-yl) benzenesulfonic acid
87. 3-Methyl-1-phenyl-2-pyrazolin-5-one
88. 5-Methyluracil
89. 6-Methyluracil
90. 2-Napthalenesulfonic acid
91. (2-Naphthylthio) acetic acid
92. 1-Nitroanthraquinone
93. Nitrobenzene
94. m-Nitrobenzenesulfonic acid
95. p-Nitrosodiphenylamine

Table 8-1-a, continued

96. 5-Nitro-o-toluenesulfonic acid
97. 1-(7-Oxo-7H-benz[de] anthracene-3-yl) amino] anthraquinone
98. 3-Oxy-4-methyl-6-chlorothionaphthalene
99. p-(Phenylazo) aniline
100. Pamoic Acid
101. N,N'-p-Phenylenebis (acetamide)
102. 3-Piperidinopropriophenone hydrochloride
103. Quinizarin
104. Rubber Processing Chemicals
    - N-Cyclohexyl-2-benzothiazolesulfenamide
    - N,N-Diisopropyl-2-benzothiazolesulfenamide
    - Diphenylamine-acetone condensate
    - 2',2'''-Dithiobis (benzanilide)
    - 2,2'-Dithiobis (benzanilide)
    - 2-Mercaptobenzothiazole
    - 2-Mercaptobenzothiazole, zinc salt
    - 2,2'-Methylenebis (6-tert-butyl-p-cresol)
    - 2,2'-Methylenebis (6-tert-butyl-4-ethylphenol)
    - 2,2'-Methylenebis (4-methyl-6-nonylphenol)
    - N-Nitrosodiphenylamine
    - Octyldiphenylamine
    - N-Oxydiethylene-2-benzothiazolesulfenamide
    - Phenol, alkylated

- Sulfanic acid
- Tetrahydroxysuccinic acid
- 1,1'-Thiobis (2-napththol)
- 4,4'-Thiodianiline
- Toluene-2,3-diamine
- p-Toluenesulfonic acid
- o-Toluidine hydrochloride
- o-(p-Toluoyl) benzoic acid
- 4-(o-Tolyazo)-o-tuoluidine
- Toxaphene
- Violanthrone
- 4-(2,5-Xylylazo)-o-toluidine
- General and Compounded Products
    - Antioxidants
    - Flame retardants

105. 4'-Sulfamoylacentanilide
106. Sulisobenzone
107. Surface-Active Agents
    - Sulfosuccinic Acid Esters
        - Sulfosuccinic acid, bis (2-ethylhexyl) ester, sodium salt
108. Thiosemicarbazide
109. 2,3,5-Trichloropyrazine
110. Uracil

In addition, American Cyanamid's permit application lists the following heavy metals in their permit application:

Barium, cobalt, chromium, copper, iron, lead, manganese, mercury, molybdenum, and zinc.

Their NPDES permit sets limits on barium, copper, chromium, iron, lead, and zinc.

Table 8-1-b

Compounds Made By American Hoechst

According to references, the following classes of compounds are made:

Agricultural chemicals
Dyes
Dye intermediates
Pigments
Polyvinyl chloride
Printing Plates

An American Hoechst official stated that none of these is produced by the plant under study. These compounds are made by American Hoechst, either at their parent plant in Germany or at other Hoechst plants.

The official further stated that the plant under study manufactures no chemicals. It mixes and compounds very high-priced pharmaceuticals, including diuretics and geriatric drugs. The nature of the plant operation makes it unlikely that any toxic chemicals are present in the wastewater.

Table 8-1-c

Compounds Made By CPS

acetone
allyl alcohol
butyl benzoate
butylcychlohexyl phthalate
n-butyl lactate
chlorobenzene
diethylaminoethyl methacrylate
dimethylacetamide
dimethylaminoethyl acrylate
dimethyl maleate
1,4 dioxane
hexyl acetate
methanol
methyl chloride
methylene chloride
methyl ethyl ketone
methyl i-butyl ketyone
i-pentyl acetate
i-pentyl alcohol
perchlorethylene
phthalic acid
i-propanol
tetrahydrofurfuryl alcohol
tetrahydrofuran
toluene
1,1,1 trichlorethane
trichloroethylene
xylene

Table 8-1-d

Compounds Made by Saytech, Inc.
Decabromodiphenyl oxide
Dibromoethyldibromocychlohexane
Pentabromoethylbenzene

Table 8-1-e

Compounds Made By Tenneco
Formaldehyde
Hexamethylene tetramine
Maleic anhydride
Tributoxyethylphosphate
Tris-2,3 Dibromopropyl phosphate

Table 8-1-f

Compounds Made By Hercules
Diazodinitrophenol
Nitrocellulose
Nitroglycerine

Literature Search: Getting Data

The principal reference handbooks used in this study to obtain toxicity data on specific compounds are "The Toxic Substances List," NIOSH, U.S. Department of Health, Education, and Welfare, Rockville, Md., 1978, and "Handbook of Environmental Data on Organic Chemicals," Karel Verschueren, Van Nostrand Reinhold Co., NYC, 1977. Other references are cited in the bibliography.

The NIOSH handbook contains over 20,000 chemical substances with some toxic data information. For most of these substances, the data are scanty, insufficient to draw a conclusion on low-level long-term toxicity. For several thousand, some idea of relative toxicity can be estimated. However, most data are on acute toxicity; many toxicologists maintain that conclusions on chronic low-level effects cannot be drawn from acute toxicity data.

The types of data summarized, wherever available, are shown in Appendix VIII-1, along with tables explaining some of the abbreviations used. Further details will be found in the NIOSH handbook under "Criteria for the Toxic Substances List."

Verscheuren's book summarizes data on over 1,000 organic chemicals. Chemicals are listed in alphabetical order by their common names. Four types of information are presented:

1. physical and chemical data
2. air pollution data
3. water pollution data
4. biological effects on microorganisms, plants, animals and man.

The data in this book are useful not only in assessing toxicity but also, as we shall see later, in evaluating exposure.

A thorough search of reference handbooks and scientific literature for data on toxicity and exposure for specific compounds can be time-consuming but rewarding.

In order to make such a search most efficiently, the Chemical Abstracts Service Registry Number for the compound should first be obtained. These unique identifying numbers are given for all compounds in the NIOSH list.

Computer information retrieval systems for toxic substances are available through most large libraries and universities, either free or at nominal cost. Best known are the "Medlars" maintained by the National Library of Medicine of the National Institute of Health. These computer systems at the present time supply literature references to toxicity and exposure data but no actual data. They sometimes contain brief abstracts of the article cited.

If the Chemical Abstract Service Registry Number is not known, it can be obtained from the computer system. Entering the number into the system will elicit the references. The references must then be obtained and reviewed.

The best procedure, if you wish to make a search, is to rely on the help of a reference librarian, who will assist you in each step of the procedure.

Computer references do not go back prior to 1970. Earlier references must be obtained by searches of abstracts. The reference librarian can show you how to make such a search.

Returning to our discussion of Chart A, we are ready to select a list of toxic or possibly toxic substances. This list is obtained by comparing the list of compounds made by a plant with public lists of toxic substances. Those compounds made by a plant which either are on a toxic substance list, are chemically analogous to compounds on such lists or which, from a brief search of our two reference handbooks appear to be possible toxic problems, appear in the list in Table 8-2.

Toxic Compounds

Chemicals on the list of toxic and possibly toxic compounds were compared with public agency lists of toxic substances. The lists used included the Natural Resources Defense Counsel Consent Decree list of 129 priority toxic pollutants (Appendix II-1); the "Reportable Quantities of Hazardous Substances" list issued by EPA in 1979 pursuant to the Clean Water Act; the "Preliminary List of Chemical Substances for Further Evaluation" issued in July, 1977 by the Interagency Testing Committee pursuant to the Toxic Substances Control Act; the Early Warning Report issued by EPA in 1979 on Chemical Hazard Information Profiles; a list of Suspect Carcinogens issued by OSHA in 1978; and a list of "Substances of Toxicological Concern" issued by the New York State Department of Environmental Conservation. These and other lists are referenced in the biblography.

In addition, a search was made in the NIOSH reference list of toxic substance and in Verscheuren's reference handbook for toxicological data on the possibly toxic compounds.

As a result of this review of the toxic and possibly toxic compounds in Table 8-2, a new list was derived. This list, shown in Table 8-3, consists of compounds considered to be toxic made by the companies under study. Compounds for which no evidence of chronic toxic effects was listed were not included in this list.

Proceeding with our methodology, we turn to evaluation of the exposure factor of these toxic chemicals.

The risk to human health and the environment posed by the 25 toxic chemicals in Table 8-3 will depend on (1) the inherent toxicity of each chemical, (2) the amount of the chemical entering the environment and (3) its fate (where it

Table 8-2

Toxic and Possibly Toxic Compounds Made by Plants Under Study

Table 8-2-a American Cyanamid*

1-Aminoanthraquinone
Aniline
Benzothiazole
Dimethylaniline
N,N-Dimethyl p-Nitrosoaniline
Naphthalene Sulfonic acid
β-Naphthol
Nitrobenzene
p-Nitrosodiphenylamine
p-Phenylazoaniline
Toluene 2,4-Diamine
p-Toluene Sulfonic Acid
o-Toluidine
Toxaphene

*Dyes are made by this plant, but their specific identities are unobtainable. Many dyes present serious toxic problems.

Table 8-2-b American Hoechst

None

Table 8-2-c C.P.S.

Allyl Alcohol
Butylcychlohexyl Phthalate
Chlorobenzene
1,4 Dioxane
Methylene Chloride
Phthalic Acid
Toluene
1,1,1 Trichlorethane
Trichloroethylene
Xylene

Table 8-2-d Hercules

Diazodinitrophenol
Nitroglycerine

Table 8-2-e Saytech

Decabromodiphenyl Oxide
Dibromoethyl Dibromocyclohexane
Pentabromoethyl Benzene

Table 8-2-f Tenneco

Formaldehyde
Hexamethylene Tetramine
Maleic Anhydride
Tris-2,3 Dibromopropyl Phosphate

Table 8-2-g

Summary of Toxic Compounds

Results can be summarized as follows:

Company	# of Compounds on Toxic Lists	# of Toxic Compounds Not on a List
American Cyanamid	5	6
American Hoechst	0	0
C.P.S.	8	1
Hercules	0	1
Saytech	0	1
Tenneco	1	2

goes and how long it persists) once it enters the environment. We will discuss the latter two factors in the following section. At this point, it is useful to inquire into the relative toxicities of the chemicals. Our goal is to rank these chemicals as to their inherent toxicity.

Table 8-4 summarizes toxicity information on each of the chemicals. The last column of the table ranks each chemical into one of three toxicity classes: severe, moderate, or low. Four points should be noted. First, the rankings, while based on data, are to some extent subjective, since the data are meager. Second, the rankings are relative. Since all compounds on the list are toxic, a ranking of low indicates a low toxicity as compared to other compounds on the list. Third, chemicals showing any evidence that they are carcinogens are ranked as "severe." Finally, in some cases it was necessary to use acute toxicity data to draw conclusions as to toxicity ranking. Since there is no necessary correlation between acute toxicity and low-level chronic toxicity, uncertainty is introduced into the ranking.

Exposure. How Long Does It Last? Where Does It Go?

The risk posed to the environment and human health by the toxic compounds made by the six companies being studied depends on the amount of these compounds, where they go, and how long they persist. The latter two points will be discussed in this section.

Once compounds enter receiving waters, environmental effects will depend on their transport, storage, and ultimate fate. At one extreme, a compound can, in its first few minutes in the water, completely disappear by vaporizing into the air, reacting with the water or other chemicals in the water, or by the destructive action of light. At the other end of the spectrum, a compound can stay in the environment indefinitely without chemical change, being transported by water for many miles, simultaneously being stored and concentrated by aquatic plants, bottom sediment, and fish. In the latter case, ingestion by and storage in human beings can result. Few compounds lie at either end of the spectrum; most lie in the vast range between the extremes.

Knowledge of the actual transport, storage, and fate of each toxic compound under study is desirable. However, our

TOXIC COMPOUNDS MADE BY PLANTS UNDER STUDY

COMPOUND	ON TOXIC LIST	COMMENTS
Table 8-3-a American Cyanamid		
1. 1-Aminoanthraquinone	—	Causes neoplasms, suspect carcinogen
2. Aniline	EPA Early Warning Report; N.Y. State Dept. of Environmental Conservation List	
3. Benzothiazole	—	Unpleasant odor detectable at parts per trillion in water
4. Dimethlaniline	Interagency Testing Committee List	
5. N,N-Dimethyl p-nitroso aniline	—	Causes neoplasms, suspect carcinogen
6. Nitrobenzene	Priority Pollutant	
7. β-Naphthol	--	Taints fish flesh; odor threshold, 1 ppm
8. p-Phenylazoaniline	—	Carcinogen
9. Toluene-2,4 Diamine	—	Causes neoplasms, suspect carcinogen
10. o-Toluidine	OSHA Class I Suspect Carcinogen	
11. Toxaphene	Priority Pollutant	
Table 8-3-b American Hoechst		
None		
Table 8-3-c CPS		
12. Allyl Alcohol	Reportable Quantities of Hazardous Substances List	Imparts odor to water at 17 ppb; maximum allowable concentration for drinking water, 0.1 ppm
13. Butylcyclohexyl Phthalate	—	No toxicity data; no CAS Registry number; half-dozen long chain phthalate esters–close relatives–are on toxic substance lists
14. Chlorobenzene	Priority Pollutant	
15. 1,4 Dioxane	OSHA Class I Suspect Carcinogen	
16. Methylene Chloride	Priority Pollutant	
17. Toluene	Interagency Testing Committee	Known human toxicity
18. 1,1,1 Trichloroethane	Priority Pollutant	
19. Trichloroethylene	OSHA Class I Suspect Carcinogen	
20. Xylene	Interagency Testing Committee List N.Y. State Dept. of Environmental Conservation List	Imparts taste and odor to water at 1 ppm; known human toxicity
Table 8-3-d Hercules		
21. Nitroglycerine	—	Only acute toxic effects described
Table 8-3-e Saytech		
22. Decabromodiphenyl Oxide	—	Thyroid hyperplasia on chronic feeding of rats; close analog of decabromodiphenyl, which is highly toxic
Table 8-3-f Tenneco		
23. Formaldehyde	Reportable Quantities on Hazardous Substances List; Interagency Testing Committee List	Known human toxicity
24. Maleic Anhydride	—	Carcinogen
25. Tris-2,3 Dibromopropyl Phosphate	—	The infamous TRIS used as a flame retardant in children's sleepwear; carcinogen

Table 8-4

Relative Ranking of 25 Toxic Compounds

Compound	Toxicity Data	Ranking
Allyl Alcohol	Maximum Allowable Concentration for water, 0.1 ppm Goldfish, LD_{50} (24 hr.) 1 ppm Mouse, LD_{50} 96 mg./kg. Rabbit, LD_{50} 71 mg./kg. Rat, LD_{50} 64-105 mg./kg. Man, Pulmonary discomfort>25 ppm Man Inhalation TC_{LO}* 25 ppm, irritant Rat oral LD_{LO}** 69 mg./kg. USOS*** TWA**** 2 ppm	Severe
1-Aminoanthraquinone	Rat oral TD_{LO} 2740 mg./kg. For 61 weeks (intermittent): Neoplams	Severe
Aniline	Maximum allowable concentration for drinking water 0.1 ppm Daphnia Toxic 0.4 ppm Man Severe Toxic effects 80 ppm, 60 min. Unsatisfactory>10 ppm Rat oral LD_{50} 440 mg./kg. USOS TWA 5 ppm	Severe
Benzothiazole	0.1% of population able to detect odor at 0.00068 ppt Mouse, intravenous LD_{50} 100 mg./kg.	Low
Butyl cychlohexyl phthalate	No data available. Similar phthalates are serious environmental problems and are carcinogens. Needs testing.	Severe (?)
Chlorobenzene	Maximum allowable concentration for drinking water 0.02 ppm Bluegills TL_m (24-96 hr.) 24 ppm Guppies TL_m (24-96 hr.) 45 ppm Man Unsatisfactory>75 ppm Rat Oral LD_{50} 2910 mg./kg. USOS TWA 75 ppm	Moderate
Decabromodiphenyl oxide	Closely related to the very toxic decabromodiphenyl	Severe
Tris-2,3 dibromo propyl phosphate	The notorious "TRIS", a carcinogen	Severe
Dimethylaniline	Rat oral LD_{LO} 1410 mg./kg. USOS air TWA 5 ppm	Moderate
N,N-Dimethyl p-nitroso aniline	Rat oral LD_{50} 65 mg./kg. Rat oral TD_{LO} 7300 mg./kg. 1 yr. neoplasms	Severe
p-Dioxane	Man inhalation LC_{LO} 470 ppm Rat oral TD_{LO} 528 mg./kg. 63 weeks carcinogen USOS TWA 100 ppm	Severe
Formaldehyde	Water quality, toxicological limit, USSR 0.5 ppm Maximum Allowable Concentration, Class 1 Surface Waters 0.5 ppm Daphnia Toxic 2 ppm Man Severe toxic effects 100 ppm, 1 min. Unsatisfactory 10 ppm Inhalation, TC_{LO} 13.8 ppm irritant Rat oral LD_{50} 800 mg./kg. subcutaneous TD_{LO} 96 mg./kg. 60 weeks neoplasms Guinea pig oral LD_{50} 260 mg./kg. USOS air TWA 3 ppm	Severe

Table 8-4, cont'd

Maleic Anhydride	Rat subcutaneous TD_{LO} 610 mg./kg./61 weeks carcinogen Rat oral LD_{LO} 850 mg./kg. Bluegill TL_m (24-hr.) 150 ppm USOS TWA 0.25 ppm	Severe
Methylene chloride	Daphnia LD_O 1250 ppm Man inhalation TC_{LO} 500 ppm 1 year intermittent central nervous system; blood effects Dog oral LD_{LO} 3000 mg./kg. USOS air TWA 500 ppm	Moderate
β-Naphthol	Tainting of fish flesh 1 ppm Odor threshold 1.29 ppm Maximum Allowable Concentration for drinking water 0.4 ppm Rat oral LD_{50} 2420 mg./kg. Rabbit oral LD_{50}3800 mg./kg.	Moderate
Nitrobenzene	Animal chronic exposure adverse effect 0.008 mg./cu.m. Faint odor in water at 30 ppb Maximum Allowable Concentration for drinking water 10.2 ppm Daphnia LD_O 28 ppm Man Severe toxic effects 200 ppm 60 mins. unsatisfactory>1 ppm Rat oral LD_{50} 640 mg./kg. Dog oral LD_{LO} 750 mg./kg. Rabbit oral LD_{LO} 600 mg./kg. USOS air TWA 1 ppm	Severe
Nitroglycerine	Daphnia LD_O 26 ppm Rat oral LD_{LO} 80 mg./kg.	Moderate
p-Phenylazoaniline	Rat dermal TD_{LO} 1600 mg./kg. 2.3 years intermittent carcinogen Mouse intraperitoneally LD_{LO} 200 mg./kg. Frog into kidney TD_{LO} 11 mg./kg. carcinogen	Severe
Toluene	Adverse taste in fish<0.25 ppm Maximum Allowable Concentration in surface waters, Rumania 0.1 ppm Daphnia LD_O 60 ppm Bluegills TL_m (24-96 hr.) 24 ppm Guppies TL_m (24-96 hr.) 63-59 ppm Salmon 9/10 at 50 ppm in 24 hrs. 10/10 at 48-96 hrs. Man unsatisfactory 100 ppm	Moderate
Toluene 2,4 diamine	Rat oral LD_{LO} 500 mg./kg. neoplasms	Severe
o-Toluidine	Daphnia LD_O 8 ppm Fish TL_m 100 ppm Man Severe toxic effects 40 ppm 60 min. Unsatisfactory 5 ppm Rat oral LD_{50} 900 mg./kg. USOS TWA 5 ppm	Moderate
Toxaphene	Man oral LD_{LO} 2000 mg./kg. Rat oral LD_{50} 60 mg./kg. Duck oral LD_{50} 71 mg./kg. Rainbow trout LC_{50} 3 ppb Daphnia LC_{50} 15 ppb Quail LC_{50} (5 days) 830 ppm in diet LD_{60} 90 mg./kg. Tadpoles LC_{50} (24 hr.) 1.7 ppm (96 hr.) 0.5 ppm	Severe

Table 8-4, cont'd

1,1,1 Trichloroethane	Fish TL_m 75-100 ppm Man inhalation TC_{LO} 350 pm Rabbit oral LD_{50} 5660 mg./kg. Guinea pig oral LD_{50} 9470 mg./kg. USOS air TWA 350 ppm	Low
Trichlorethylene	Odor threshold in water 10 ppm orgaoleptic limit 0.5 ppm Daphnia LD_{100} 600 ppm 40 hr. no effect 100 ppm Man unsatisfactory>400 ppm Rat oral LD_{50} 4920 mg./kg. Dog oral LD_{60} 5860 mg./kg. USOS air TWA 100 ppm	Low
Xylene	Bluegills TL_m (24-96 hr.) 24-21 ppm Guppies TL_m (24-96 hr.) 35 ppm Man inhalation TC_{LO} 200 ppm irritant Rat oral LD_{50} 4300 ppm	Low

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*TC_{LO} = lowest concentration in air reported to produce a toxic effect
**LD_{LO} = lowest dose reported to cause death
***USOS = OSHA standard
****TWA = Time weighted average
(Note: TL_m = median tolerance limit; LC_{50} = lethal concentration to 50% of test population; LD_{50} = lethal dose to 50% of test population;TD_{LO} = lowest dose reported to be toxic; LD_0 = dose not lethal to any of test population).

data bank for these environmental factors is even more meager than our knowledge of toxicities.

The factors influencing exposure can be evaluated by certain physical and chemical criteria: characteristics of a compound which correlate with the transport, storage and fate of the compound in the receiving waters. Chart B lists the exposure factors which we are trying to determine and the principal criteria used to evaluate them.

Water solubility is the maximum concentration of the substance which will dissolve in water, usually given in grams (g) per 100 ml, or milligrams (mg) or micrograms (ug), dissolved per liter of water. These concentrations may alternatively be expressed as percent, parts per million (ppm), parts per billion (ppb), or parts per trillion (ppt). Solubilities range from infinite (miscible) to zero (the amount dissolved is not detectable). Water solubility is an important indicator of transport, since a compound dissolved in water will tend to stay in the water and be subject to rapid dilution. Undissolved compounds will be suspended in the water and may settle to the bottom or be transported with moving water.

Ordinarily, a compound whose maximum solubility is say only 5 mg/ l (5 ppm) in water would be considered insoluble in water. But such a conclusion is unwarranted in considering environmental exposure. A compound in water at 5 ppm, or even at 1 ppb or 1 ppt may still exert a significant environmental effect, both because biological effects can occur at very low concentrations and because the compound's concentration can be increased by bioaccumulation.

A compound's water solubility is usually cited in the literature.

Organic solvent solubility is the maximum concentration of the substance which will dissolve in a specified organic solvent, such as alcohol, octanol, or benzene. Solubility of a compound will vary from solvent to solvent. Of greatest relevance to exposure is solubility in octanol. Octanol solubility is an indicator of the compound's solubility in fat; the higher the octanol solubility, the more likely it is, other things being equal, that the compound can be accumulated in fatty tissue—of fish or water-fowl, for example. While organic solubility of a compound in one or more solvents is usually given in the literature, octanol solubility is often not given.

Partition coefficient is a measure of how soluble a compound is in an organic solvent, usually octanol, as compared to its solubility in water. Specifically, environmental scientists usually mean by partition coefficient the logarithm of octanol solubility divided by water solubility. For example, consider a compound whose solubility in octanol is 1,000 ppm and in water is 1 ppm. Then the octanol solubility divided by the water solubility is 1,000/ 1 = 1,000. The partition coefficient is the logarithm of 1,000, or 3. (The reason for using a logarithmic scale is to avoid very large and very small numbers). If solubilities in octanol and water are equal, the partition coefficient is zero. Partition coefficients lower than zero indicate greater solubility in water than in octanol; greater than zero indicates the reverse.

The partition coefficient is a very important environmental indicator.

Vapor pressure is a measure of the volatility of a compound, a measure of the compound's tendency to evaporate out of the water into the atmosphere. Vapor pressure is usually given in millimeters of mercury (mm Hg). Atmosphere pressure is 760 mm Hg.

Vapor pressure increases as temperature increases. Data at temperatures other than 20°C. can often be used to estimate vapor presure at 20° C.

The vapor pressure of water is about 17 mm Hg at 20° C. As a useful rule of thumb, 20° C. vapor pressures above about 1 mm Hg indicate meaningful volatility; pressures below about 10^{-2} mm Hg indicate non-volatility, with 10^{-2} to 1 being a boundary range. Physical bonding, such as hydrogen bonding, between water and the compound may significantly reduce volatility.

Particle size gives the dimensions of particles suspended in water. If a particle has a density close to one, whether it sinks or floats will depend to some extent on the particle size. The smaller the particle, the greater the tendency to remain in suspension in water. Data on particle size must be obtained experimentally for the specific discharge.

Hydrolysis rate measures the chemical stability or reactivity to water. If a compound is rapidly decomposed (destroyed or hydrolyzed) by water, it is not environmentally important, though its decomposition products may be. Hydrolysis rate may be defined by half-life (the time taken for half the substance to hydrolyze) or by a so-called rate constant.

Information on hydrolysis rates, when high, is usually in the technical literature.

Photolysis rate measures a chemical's stability to energy rays in the atmosphere. Information is sparse. Certain types of compounds, such as unsaturated molecules, tend to have higher photolysis rates. Environmentally, only compounds near the surface of water or soil would be affected.

Oxidation-reduction stability is a measure of how rapidly a compound is decomposed by oxygen or other oxidizing agents, or by reducing agents, such as sulfites, which may be present in the water. Data are rare.

Persistence refers to the length of time a compound, once introduced into the environment, stays there. A compound may persist for less than a second or for eternity.

If your environmental interest is confined to the waters in your own area, then persistence might be quite different than if your concern were a larger area. The factor of transport becomes involved, as we describe shortly. All nine indicators play a part in overall persistence.

Biodegradability is the tendency of the compound to be chemically changed by organisms present in a sewage treatment system or in the environment. Information is available for a limited number of compounds. BOD is a measure of this.

Bioaccumulation and biomagnification are important concepts in evaluating exposure to a compound. If a compound enters the body of a fish, accumulates and concentrates in its tissues, a compound present in water at say 1 ppm could reach levels many times that high in fish tissue. If the compound is toxic, such bioaccumulation poses a risk to the fish and to the food chain which feeds on fish, including human beings. Such accumulation has been a major factor in the problems resulting from such notoriously high-risk chemicals as DDT and PCB.

Adsorption on aquatic plants, and on particles either in the water column or in bottom sediment, is also environmentally important. Adsorption leads to bioaccumulation, since aquatic organisms feeding on aquatic plants, sediments, or detritus will ingest adsorbed toxics. Adsorption can be determined experimentally by shaking an aqueous solution of the compound with plants or sediment and analyzing the plants or sediment subsequently for the compound. Partition coefficient has sometimes been used as an estimate of the tendency to adsorb on plants, higher coefficients indicating greater tendency.

Transport is the ability of a compound to move away from the area where it is introduced into the environment. The rate of water flow is an obvious factor in transport. High water solubility and low organic solvent solubility are indicators that the compound will be dissolved and diluted by the water rather than be deposited in sediment, and be adsorbed by plant life or enter aquatic organisms such as fish and shellfish.

Low vapor pressures indicate lack of loss to the atmosphere. High density and particle size, along with insolubility in water, indicate loss by sedimentation. Low stability to hydrolysis, photolysis, or oxidation-reduction are indicators of low transport potential.

Getting and Interpreting Data

The methods of getting information on these exposure factors are very similar to that given in the toxicity section on literature search. Much less data are available for the environmental factors and for most of the indicators (solubility data are widely available) than for toxicity.

Verscheurer's book contains some, but very little information.

To get what little the reference handbooks and literature contain, the advice given under the toxicity literature search also applies here: rely on the help of a reference librarian in a large library or university. Most references have not been computerized, increasing the time needed. A list of reference books is in the bibliography.

Now for the good news. First, interest in this field is growing, so that much more information can be anticipated in the next few years. Second, this information is starting to go into information retrieval systems. Finally, there are more or less sophisticated ways to estimate some of the indicators and factors. These estimating techniques are also an active research area and techniques are improving.

To use the techniques requires training in chemistry and physics. However, by working with a scientist in a university or public interest group, you may be able to get helpful information.

Briefly, these techniques involve estimation of solubility, partition coefficient, stability to water and light, and oxidation-reduction from the detailed structure of the molecule of the compound being evaluated.

For example, research is going on to devise mathematical-chemical formulae to translate structures into partition coefficients. Such translation can be made in a rough, ball-park kind of way by skilled scientists even without the use of these formulae. Even one not so skilled could predict that for example, aniline, which is quite polar, would have a low partition coefficient, far lower than, say, that for 1,1,1 trichlorethylene. These predictions are based primarily on the kinds of atoms and groupings of atoms in the molecule and on their electrical charge or polarity.

Similarly, rough predictions on rate of hydrolysis, rate of oxidation or reduction, and photolytic stability can be made based on such chemical structural factors as unsaturation and presence of reactive groups such as hydroxy, amino, or cyano radicals.

However, you should keep in mind that these are crude predictions and in any given case could be quite misleading. Used judiciously, with knowledge of the pitfalls and limitations, such an approach can be of value.

An Exposure Example: Decabromodiphenyl Oxide

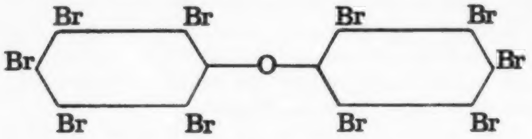
An illustrative example of the use of these exposure factors should help clarify how Chart B can be used.

Decabromodiphenyl oxide (DBDO) was selected as the example since it is a very close relative to PCB's and PBB's—persistent toxic compounds which have caused extensive problems in the environment.

DBDO is made by Saytech as noted in Table 8-2-e.

The data obtained from the literature are as follows:

Molecular Structure:



Used as flame retardant in plastics.
Water Solubility: 20-30 ppb.
Organic Solvent Solubility: In benzene, 4.8 g/l
Partition Coefficient: 5.2
Vapor presure: Less than 1 mm Hg at 250° C.
Density: No data
Particle size: Not applicable
Hydrolysis rate: No data
Photolysis rate: Sunlamp, 7 ppm in octanol, $t_{1/2} = 4$ hours
in xylene, $t_{1/2} = 15$ hours
Sunlight in water, $t_{1/2}$ 1 month
Oxidation-reduction stability: No data
Persistence: See following discussion
Biodegradability: Low, not metabolized
Bioaccumulation: Significant; 6 ppb in fish flesh after 48 hours exposure
Adsorption on aquatic plants: No data
Transport: See following discussion

From the molecular structure of DBDO, it is estimated that its density is significantly greater than one, so that suspended DBDO would tend to sink to the bottom.

The very low water solubility indicates that the main potential environmental concern from wastewater discharge of DBDO is by bioaccumulation and plant adsorption.

The molecular structure strongly suggests that DBDO is stable to oxidation-reduction and to hydrolysis.

The low water solubility and high organic solvent solubility strongly suggest a significant degree of adsorption by aquatic plants.

From the foregoing, predictions can be made as to exposure and environmental fate.

DBDO is highly persistent. Once in the water, it is removed and rendered non-toxic only by photolysis. It would be expected that only a very minor amount of dissolved DBDO would be removed in this manner. In view of the very low solubility, some sedimentation near the plant outfall is possible.

Volatility, hydrolysis, oxidation or reduction, and biodegradation are insignificant environmental pathways for removal.

DBDO could be transported for long distances, during which DBDO would be removed by adsorption on aquatic plants and entrance into the bodies of fish and other aquatic animals. It could accumulate and be a threat to the food chain if amounts were significant.

How Much Toxic Material?

We now turn to the right-hand side of Chart A to estimate the total amount of toxic material put into the receiving waters.

We have already noted the difficulty in obtaining information on the products made by plants. Information on the amount of products made by a plant is virtually nonexistent.

We did learn that C.P.S. is estimated to make 10,000 to 40,000 pounds of total product per day and that Tenneco makes 185 million pounds of 37 percent formaldehyde solution and 22 million pounds of hexamethylenetetramine annually. No other information was obtained.

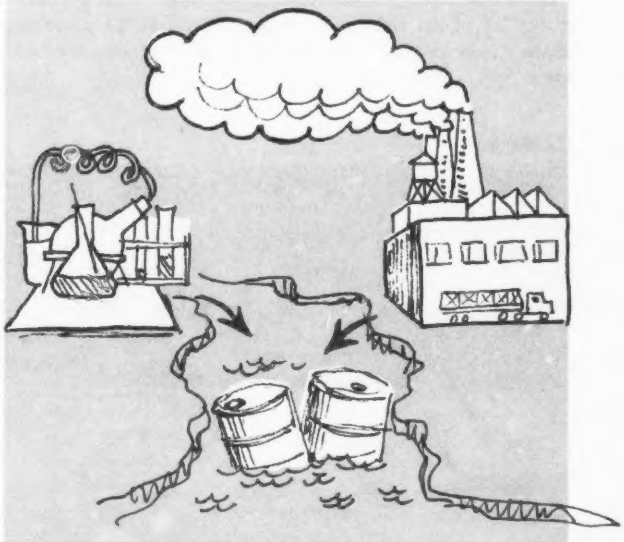
An estimate of toxicant amounts was made from data on the total flow of effluent wastewater from each plant. These data are given in Table 8-5.

It was assumed that, as a very rough approximation, the total effluent was a measure of the total product produced. An even more critical assumption had to be made, namely how much of the total effluent was attributable to the toxic substances made by the plant. None of our information sources gave us this information. Nevertheless, some conclusions can be drawn. In general, we assumed each compound made by a plant gave the same amount of wastewater. This assumption is obviously not entirely accurate, but is a

Table 8-5

Effluent Volume

Company	Total effluent gallons per day X 10^{-6}
American Cyanamid	21
American Hoechst	0.2
C.P.S.	0.12
Hercules	2.1
Saytech	0.12
Tenneco	1.6



reasonable working assumption absent additional facts. Let us discuss the situation, plant by plant.

American Cyanamid is by far the largest plant, with an effluent of 21 million gallons a day. We list about 100 chemicals made, of which 11 are on our toxic list. We know that the list of compounds made is much greater than 100. (We have heard estimates ranging from 800 to 6,000 different compounds.)

We do not know what percentage of this larger number of compounds would meet our criteria of classification as toxic. We further know that Cyanamid does not specify the dyes or pesticides it makes—these compounds probably increase significantly the percent of effluent due to toxics.

Taking all these considerations into account, plus the fact that, of the compounds listed as made, many could be toxic but no data one way or the other were available, we estimate that 25 percent of the effluent is due to toxics, or 5 million gallons a day.

American Hoechst is an indirect discharger. The POTW receiving their discharge states that its volume is 0.2 million gallons a day. Since the plant, to our knowledge, makes no toxic compounds—but we cannot state that as an absolute fact—we estimate the volume of toxic effluent, on this basis, as one percent of the total discharge, or 0.002 million gallons a day.

Total C.P.S. effluent is 0.12 million gallons a day. Of the 28 total chemicals listed as made, 9 are on our toxic list. We estimate that effluent due to toxics is $0.12 \times 10^6 \times 9/28 = 0.04$ million gallons a day.

Hercules has three compounds on its list of total chemicals made, with an effluent of 2.1 million gallons. Of the three, one is considered toxic, so effluent due to toxics is estimated as $2.1 \times 10^6 \times 1/3 = 0.07$ million gallons a day.

Saytech with an effluent of 0.12 million gallons a day, makes three compounds, of which one is classified as toxic. We calculate effluent due to toxics as $0.12 \times 10^6 \times 1/3 = 0.04$ million gallons a day.

Tenneco, with a total effluent of 1.6 million gallons a day, makes chemicals, three of which are toxic. We have been informed that formaldehyde is a large volume chemical. We therefore used 65 percent rather than 60 percent as a calculation factor. Effluent due to toxics is 1 million gallons a day.

Assuming that the concentrations of toxics in the effluents of the six plants are all the same, we can tabulate our estimate of the relative amount of total toxics produced as follows:

Table 8-6

Relative Amount of Toxic Compounds Made

American Cyanamid	2500
American Hoechst	1
C.P.S.	20
Hercules	35
Saytech	20
Tenneco	500

Two of the plants, American Cyanamid and Saytech, have special activated carbon treatment plants which will reduce the amount of toxic substances entering into the receiving waters. Tenneco holds its wastewater, prior to treatment, in a holding lagoon, where it is treated with lime and the solid allowed to settle.

American Cyanamid is now treating the effluent from its sewage treatment plant with activated carbon. This treatment, according to a company official, reduces total organics by about one-half (40 to 50 percent). No data exist on the removal of specific compounds.

Saytech is building an activated carbon treatment system which will reduce its toxic product by over 90 percent.

Tenneco's pretreatment with lime should convert formaldehyde to formic acid. It is possible that maleic anhydride is also decomposed. On this basis we are assuming a 50 percent reduction in toxic effluent.

This information modifies the previous list as follows.

Table 8-7

Relative Amount of Toxic Compounds Into Receiving Waters

American Cyanamid	1250
American Hoechst	1
C.P.S.	20
Hercules	35
Saytech	2
Tenneco	250

This table, giving relative rankings of the amounts of toxics put into receiving waters by the plants under study, can now be compared, plant by plant, with the list of toxic compounds made. This comparison will give an estimate of the relative risk to health and the environment for each plant.

It is especially important to remember that the entire prioritization methodology suffers in precision from lack of data and the necessary making of assumptions. Conclusions drawn are probabilities. It is believed that use of the methodology will increase the probability that, by concentrating efforts on plants with the highest estimated risk potential, time and resources will be used more efficiently than by random selection of plants.

Relative Risk Evaluation

Information on toxic compounds made by each plant can now be combined with estimates of the relative amounts of these compounds discharged into receiving waters, so as to evaluate risk.

The rating thus given to the plants has no absolute basis. As a result of the analysis in this handbook, it is not possible to say that the discharge from a given plant does or does not present an unreasonable risk to health and the environment.

Table 8-8

Estimated Relative Risk Ratings of Plants Under Study

Company	Relative Amount of Toxic Effluent	Toxicity Severity of Effluent	Exposure Comments	Estimated Risk Ranking
American Cyanamid	High	High; about half of toxics may be carcinogens	All toxics persistent; most bioaccumulate	High
American Hoechst	Low	Low	—	Low
C.P.S.	Moderate	High; close to half of toxics may be carcinogens	Some of toxic substances impart odor to river; most persistent, some bioaccumulate	Moderate to High
Hercules	Moderate	Moderate; carcinogens	Moderate persistence; no bioaccumulation	Low
Saytech (after pretreatment)	Low	Low	Persistent; bioaccumulate	Low
Tenneco	Moderate	High; carcinogens	Moderately persistent; no bioaccumulation	Moderate

Ratings made according to the methodology in this handbook will nevertheless help citizens trying to decrease the amount of toxic substances in waterways in their community. Ratings will enable citizens to concentrate their limited time and resources on those plants with the highest risk ratings. While ratings are subject to many uncertainties because of the poor data base, using the ratings should be far preferable to depending on random selection of plants.

Ratings of the plants are summarized in Table 8-8.

American Cyanamid

American Cyanamid makes the greatest number of toxic compounds (11) of any company on the list. Of these compounds, two are priority pollutants. Of the other nine, three are suspect carcinogens and two are reported in the literature as carcinogens. All 11 compounds are persistent once discharged, though some of them would not be expected to bioaccumulate.

American Cyanamid's estimated discharge of toxic substances is the highest of any of the six plants.

In view of both the quantity and nature of the toxic discharges, American Cyanamid exhibits the probability of a high risk factor.

American Hoechst

In view of the fact that American Hoechst mixes and compounds high priced pharmaceuticals, its risk is considered to be very low.

C.P.S.

C.P.S. makes nine toxic compounds, almost as many as American Cyanamid. The volumes involved, however, are much smaller, estimated as about $\frac{1}{50}$ as much.

Of the nine toxic compounds, three are priority pollutants and two are suspect carcinogens. Butyl cyclohexyl phthalate may also be a carcinogen. Most of the compounds are persistent, some may bioaccumulate and two impact offensive odors to water at very low concentrations.

C.P.S. exhibits the probability of a high risk factor, lower than American Cyanamid only because of its smaller size. Unlike American Cyanamid, C.P.S. has apparently taken no action to pretreat its discharge.

Hercules

Hercules makes one toxic compound, nitroglycerine. Toxic effluent volume is about double that of C.P.S. However, nitroglycerine's persistence, while appreciable, would be estimated as less than that for most of the toxics made by American Cyanamid and C.P.S. Bioaccumulation will not occur.

It is concluded that the toxic risks from Hercules are likely to be relatively low.

Saytech

Saytech makes one toxic compound, decabromodiphenyl oxide. This compound causes chronic toxic effects at low levels. It is persistent in the environment and bioaccumulates.

However, Saytech's volume is small. Furthermore, it is in the last stages of installing a pretreatment system which removes up to 97 percent of the discharged DBDO. Once the pretreatment system is in operation, Saytech's risk factor is probably low.

A more detailed description of Saytech is included in Chapter V of this handbook.

Tenneco

Tenneco makes three toxic compounds, two of which are reported as carcinogens. Its volume of toxic compounds is second only to American Cyanamid. Pretreatment is used which helps lower the discharge of toxics. The two carcinogens are moderately persistent in the environment but would not be expected to bioaccumulate.

Based on the foregoing, Tenneco's risk factor would be estimated as moderate, below that of American Cyanamid and C.P.S. but greater than Hercules, Saytech, or American Hoechst.

In the Future

The procedure we have devised and used to evaluate relative risks from various plants is admittedly imprecise, though useful. We have noted time and again the lack of data and the need to make assumptions of doubtful validity.

However, there is an optimistic side. As the data base grows, as more information is gathered and made public on production, toxicity, and exposure, the precision of this methodology will improve. Especially useful will be EPA's inventory of toxic substances, which contains production data by plant. EPA has also started to gather analytical data on toxic discharges arising from specific plants.

These data can be supplemented by bioassay information on the toxicity of plant discharges, if EPA decides to require such data.

Finally, it may be possible for public interest groups, working through universities, to obtain experimental data not available from public agencies.

Chapter IX Summary

What Is My State Doing?

This Chapter discusses the results of an NWF survey of state toxic substances programs. The survey was conducted in the first quarter of 1979 and all those polled—the 50 states, 3 territories, and the District of Columbia–responded. All 54 responses were evaluated and ranked.

The top 11 states (Ohio and Vermont tied for 10th) are California, Maryland, Tennessee, South Carolina, Washington, Delaware, Oregon, Connecticut, Florida, Ohio, and Vermont. However, even California, which ranked highest in the survey scored no better than a C-plus (34 out of a possible 43) in terms of the scope and adequacy of its toxic substances program. A number of high-ranking states, similarly, seem less adequate when considered in relation to the size of their hazardous wastes problem. Thus, Ohio, California, and Tennessee are all among the top ten hazardous waste *generating* states in the nation.

The lowest-ranking 11 states (Maine and Mississippi tied for forty-fifth place) are Maine, Mississippi, Idaho, Puerto Rico, Georgia, New Hampshire, Virgin Islands, Nevada, South Dakota, Arizona, and Guam (lowest-ranking).

Survey results indicate that the risk of serious environmental degradation from unknown toxic wastes dumped in poorly situated landfills remains high in most states. Among the reasons for this assessment are the fact that (1) less than half of the states regulate the siting of hazardous waste landfills, (2) nearly half of the states require no assessment of the toxic chemical content of wastes proposed for landfilling, (3) less than a quarter of the states require labeling of landfill-disposed hazardous waste containers, (4) less than one-quarter of the states require hazardous waste landfill operators to carry out water quality monitoring after termination of landfill use, (5) more than a third of the states absolve waste generators of responsibility for toxic wastes after they are turned over to a hauler or processor, and (6) more than a quarter of the states exempt on-site storage or disposal of hazardous wastes from some or all of the regulatory requirements that would apply if the wastes were stored or disposed of off-site.

The survey identified other problems concerning the water discharge of toxic chemicals.

If your state fails to move far enough, quickly enough, it is up to you to let your government representatives know that more must be done.

CHAPTER IX

What Is My State Doing?

The National Wildlife Federation (NWF) surveyed state toxic substances programs in the first quarter of 1979 to determine the adequacy of currency hazardous waste laws and regulations throughout the nation. A questionnaire (see, Appendix IX-1) was sent to the 50 states, the District of Columbia, and the territories of Guam, the Virgin Islands, and Puerto Rico; all responded.

The 54 responses were evaluated and ranked. A number of states might have received higher rankings had they been evaluated on the basis of expected rather than existing legal authorities, and if discretionary implementing authority had been counted in the evaluation. (See, Appendix IX-2 for further explanation of the survey).

The top scoring states were: (1) California; (2) Maryland; (3) Tennessee; (4) South Carolina; (5) Washington; (6) Delaware; (7) Oregon; (8) Connecticut; (9) Florida; and (10) Ohio and Vermont (tied for tenth place).

The lowest scoring staes were: (54) Guam; (53) Arizona; (52) South Dakota; (51) Nevada; (50) Virgin Islands; (49) New Hampshire; (48) Georgia; (47) Puerto Rico; (46) Idaho; (45) Mississippi and Maine (tied for forty-fifth place).

A number of high-scoring states seem less praiseworthy when two factors are considered. First, even the highest ranking state—California—scored no better than a C-plus (34 out of a posible 43) in terms of the scope and adequacy of its toxic substances program. Thus, while the top-scoring states compare well to other states, their programs fall far short of perfection when viewed on their own merits. Second, a number of the states which ranked highest in the general adequacy of their toxic substances regulatory program are also among the heaviest hazardous waste generating states in the nation. For example, Ohio, California, and Tennessee—all ranked within the top ten—also happen to be among the top ten hazardous waste *generating* states in the nation. Citizens of these states might well feel less secure than those in other, less prolific hazardous waste generators—even though those other states may have less adequate toxic substance statutes and regulations.

Table 9-1 lists the 50 states and the District of Columbia in order of hazardous waste generation (based upon estimates developed by an EPA contractor); New Jersey—the heaviest generator—is listed first. This is followed by a ranking of these states based on the NWF survey.

The major substantive findings and conclusions of the NWF survey can be summarized as follows:

Comprehensive Programs for Controlling Toxics

1. Only 7 states (13%) have a specific toxic substances law.

2. Only 13 states (24%) have a State agency or official with overall responsibility for coordinating or regulating toxic substances.

3. Only 9 states (17%) have a legally-specified list of toxic and/or hazardous wastes (it is difficult to regulate such wastes if you don't know what they are).

Toxics Emergencies

4. Nearly two-thirds of the states (62%) have established 24-hour-a-day emergency telephone numbers for reporting toxic substances emergencies.

5. Only 4 states (7%) require users of producers of toxic chemicals, as opposed to waste generators, to furnish information on these chemicals to the state. Without information on the raw materials used and the products produced, it is difficult to objectively evaluate the presence and content of potential toxic discharges.

6. Fifteen states have fully addressed none of these measures; and only California has taken all the steps addressed in these items.

7. Only 23 states (43%) have established procedures for dealing with toxic chemical emergencies (including a 24-hour-a-day emergency telephone number).

Public Participation

8. The majority of the states encourage public participation in the process of regulating toxic substances (54%) and allow citizens to examine toxic substances information in the state's possession (70%), subject to applicable "trade secret" and "confidentiality" restrictions; however, less than one-third (31%) of the states clearly authorize lawsuits by private citizens against individuals and/or state agencies where state laws regulating toxic substances have been violated or are not being enforced.

9. The "big ten" states—the ones responsible for 60% of the Nation's hazardous waste—score better in these areas than the states as a whole. All of these states, with the

Less than a third of the states have a legally-mandated record-keeping and data retrieval system for keeping track of hazardous wastes disposed of at active or abandoned landfills. Credit: EPA Office of Solid Waste

Table 9-1

STATE	Ranking By Hazardous Waste Generation (1)	Ranking from Survey Results (2)
New Jersey	1	12
Ohio	2	10
Illinois	3	17
California	4	1
Pennsylvania	5	15
Texas	6	13
New York	7	16
Michigan	8	28
Tennessee	9	3
Indiana	10	25
North Carolina	11	14
Virginia	12	23
Missouri	13	39
Louisiana	14	18
South Carolina	15	4
Massachusetts	16	31
Florida	17	9
Wisconsin	18	30
West Virginia	19	43
Georgia	20	48
Connecticut	21	8
Kentucky	22	42
Alabama	23	19
Maryland	24	2
Minnesota	25	32
Washington	26	5
Iowa	27	35
Kansas	28	20
Delaware	29	6
Mississippi	30	45
Arkansas	31	22
Colorado	32	41
Oklahoma	33	21
Oregon	34	7
Rhode Island	35	26
Idaho	36	46
Maine	37	44
Nebraska	38	40
Arizona	39	53
New Hampshire	40	49
Utah	41	36
New Mexico	42	33
Montana	43	29
Vermont	44	11
Nevada	45	51
Alaska	46	37
D.C.	47	27
Hawaii	48	38
North Dakota	49	34
South Dakota	50	52
Wyoming	51*	24

*The EPA contractor study, from which column (1) is derived, evaluated only the 50 States plus the District of Columbia; the NWF Survey, represented in Column 2, studied an additional three territories (i.e., Guam, Virgin Islands, and Puerto Rico). Only the 51 "States" common to both studies are included in this table.

exception of Ohio, encourage public participation in toxic substances decision-making. And all of these states, except Ohio and Tennessee, allow citizen access to toxic substance information. However, 40% of the "big ten" states could not say that they allow citizen suits on toxic substances issues (i.e., OH, PA, TN, TX).

10. Less than one-quarter of the states (24%) could lay claim to encouraging public involvement in all three respects addressed in the survey. Fully one-fifth (20%) of the states could not say they allowed full public participation in *any* of these areas.

11. A number of the states lacking adequate public participation mechanisms are states which have taken over responsibility from the Federal Government for operating the National Pollutant Discharge Elimination System ("NPDES") permit program under the Clean Water Act—despite the strong public participation requirement of that law.

State-Assumption of NPDES Permit Program

12. Thirty states (56%) have been delegated NPDES permit authority under the Clean Water Act.

13. Less than a third (30%) of these states have adopted controls on the water discharge of toxic pollutants which go beyond those of Federal law.

14. Eighty percent of the "big ten" states have been delegated NPDES permit authority; only New Jersey and Texas have not received this authority. Five of the eight NPDES-states among the "big ten" have established programs which go beyond those of Federal law.

15. NPDES-states, even those that do not regard themselves as departing from basic Federal program requirements, have established quite different NPDES programs. Although uniformity was a basic purpose behind establishment of a Federal water pollution law, this goal has clearly not been achieved—at least as far as NPDES-states are concerned.

16. NPDES-states scored slightly higher than non-NPDES-states (on the average) in their responses to the twelve water discharge questions addressed in the survey.

Disposal of Unused Pesticides

17. Fewer than half the states (48%) regulate the disposal of pesticides by individuals (e.g., farmers and homeowners); discarded pesticide containers are almost certainly even less widely regulated.

Recycling of Waste Oils

18. Less than one-third (30%) of the states require or encourage the proper disposal or recycling of waste lubricating oils by individuals.

Prevention of Toxic Water Pollution

19. Less than one-quarter of the states (24%) impose specific discharge limits on toxic or hazardous chemicals.

20. Less than one-quarter of the states (22%) require toxicity testing of proposed discharges known to contain or suspected of containing toxic and hazardous chemicals.

21. Only two states (NC, TN) require consideration of the effects of adsorption of contaminants to bottom sediments in evaluating the toxicity of proposed discharges—despite the fact that sediment-adsorbed contaminants can poison aquatic food chains.

22. Only five states (CT, FL, NM, VT, WY) explicitly limit the discharge of known or suspected carcinogens, mutagens, and teratogens.

23. Nearly half the states (48%) do not regulate the discharge of toxic and hazardous chemicals into Publicly-Owned Treatment Works and/or require pretreatment of such discharges—despite the fact that the majority of toxic discharges enter waterways by way of sewage treatment plants.

24. More than two-thirds of the states (70%) fail to require State-issued discharge permits to include quantitative limits on effluent levels of specified toxic and hazardous chemicals.

25. Although the "big ten" states outscored the country as a whole on the six questions (items 19-24) addressing the comprehensiveness of states water pollution control programs, none of these states has adopted all six measures; two (NY, OH) have adopted *none* of them, and the greatest number adopted by any of them is three (CA, PA, TN).

26. Throughout the country, no state answered all six questions "correctly." The closest was North Carolina, with five of the six.

Surface & Ground Water Monitoring

27. Less than a quarter of the states (22%) require chemical dischargers to participate in periodic monitoring to help evaluate the effects of their discharges on receiving waters; however, nearly two/thirds of the states (63%) impose requirements on landfill owners or operators.

28. Three-fifths of the states (60%) require the state itself to periodically monitor state waters, sediments, and biota to detect the effects of waste discharges.

29. Of the thirty-four states that impose water monitoring requirements on landfill operators, only slightly more than half (59)% require monitoring to continue beyond the termination of landfill use.

30. Only three states (CA, OH, TN)—all of them on the list of "big ten" polluters—answered all four monitoring questions "correctly."

Groundwater Protection

31. Only a quarter of the states (26%) have set numerical water quality criteria applicable to toxic chemicals in groundwater or limit underground disposal of toxic and hazardous wastes.

Waste lubricating oils need not be discarded. They can be recycled for re-use as a lubricating oil, for use as fuel oil, for dust control by spreading on roads, and for mixing with asphalt in road construction and repair. All of this can be effectively done on a state level. Credit: Grant Heilman

32. Only half the states (50%) require precautions to prevent contamination of ground or surface waters due to the rupture of hazardous waste storage containers.

33. Only four states (OR, SC, TN, WI) specify maximum time limits for storage of hazardous waste containers before disposal at an approved site (or before re-examination of the containers is required to forestall corrosion and leakage).

34. Overall, no state has adopted all five groundwater protection measures addressed in the survey, but five states (DE, NC, OR, TN, WI) have adopted four of the five. Three of the "big ten" states (MI, NJ, TX) have adopted only one or two of the five measures dealt with in the survey, and only one "big ten" state (TN) has adopted as many as four.

Hazardous Waste Management

35. More than a third of the states (37%) absolve waste generators of responsibility for toxic wastes after they are turned over to a licensed waste disposal or processing firm.

36. More than a quarter of the states (28%) exempt onsite hazardous waste disposers or storers from some or all of the regulatory requirements that would apply if the wastes were stored or disposed of off-site.

37. Less than a third of the states (31%) have the legal authority to require users and producers of toxic and hazardous chemicals to conduct a material balance to account for environmentally significant losses of toxic materials.

38. Even among the seventeen states which have this legal authority, only two (AR, CT) frequently or routinely utilize it.

39. More than three-quarters of the states require a permit, license, or other approval for: depositing toxic and hazardous chemicals in a landfill; initiating and operating hazardous waste landfills; plans and specifications for the design and operation of hazardous waste landfills. However, three states (AZ, NV, VI) require *none* of these measures, and seven states (AK, CO, DC, MI, MT, NH, VT) fail to require two or more of these measures.

40. Less than half of the states (43%) require state approval for methods of containerization and pretreatment of hazardous wastes proposed for landfilling.

41. Less than half of the states (44%) regulate the siting of hazardous waste landfills either by segregating the disposal of toxic and non-toxic wastes at different landfills or by specifying any areas in which hazardous waste landfills may not be established (e.g., within a specified distance from a waterway).

Identification of Toxic Chemical Content of Hazardous Wastes

42. Nearly half the states (48%) require no assessment of the toxic chemical content of wastes proposed for landfilling.

43. Less than half the states (41%) require landfill operators to maintain a detailed listing of toxic chemicals landfilled.

44. Less than a quarter of the states (24%) require labeling of landfill-disposed hazardous waste containers.

45. Five states (LA, MD, NC, OR, SC) require all four measures addressed in the survey for characterizing hazardous wastes; however, twenty-one states cannot claim to require *any* of the four.

46. None of the "big ten" states answered all four questions relating to hazardous waste characterization "correctly"; Indiana could answer *none* correctly.

Controls on Abandoned Dumps

47. Only one state in five (20%) requires transfer to the state of hazardous waste landfill records when the landfill closes down.

48. Less than a third of the states (31%) have a legally-mandated recordkeeping and data retrieval system for keeping track of hazardous wastes disposed of at active or abandoned landfills.

49. Only a third of the states (33%) impose bonding requirements on hazardous waste landfill owners or operators to ensure proper closure/decommissioning of landfill sites.

50. Only two states (DE, KS) have adopted all four of the abandoned dump control measures addressed in the survey, while twenty-one states could not claim to have adopted *any* of these measures—including Michigan among the "big ten" states which generate the majority of the country's hazardous wastes.

The results of the NWF survey indicate that the risk of serious environmental degradation from unknown toxic wastes dumped in poorly situated landfills remains high in most states. Among the reasons for this gloomy assessment are the facts that (1) less than half of the states regulate the siting of hazardous waste landfills, (2) nearly half of the states require no assessment of the toxic chemical content of wastes proposed for landfilling, (3) less than a quarter of the states require labeling of landfill-disposed hazardous waste containers, (4) less than one-quarter of the states require hazardous waste landfill operators to carry out water quality monitoring after termination of landfill use, (5) more than a third of the states absolve waste generators of responsibility for toxic wastes after they are turned over to a hauler or processor, and (6) more than a quarter of the states exempt on-site storage or disposal of hazardous wastes from some or all of the regulatory requirements that would apply if the wastes were stored or disposed of off-site.

From the standpoint of water pollution, less than a quarter of the states impose specific discharge limits on toxic or hazardous chemicals or even require toxicity testing of proposed discharges known or suspected to contain toxic and hazardous chemicals. Only five states place specific limits on the discharge of known or suspected carcinogens, mutagens, and teratogens. And nearly half the states fail to regulate the discharge of toxic chemicals into sewage treatment plants—despite the fact that the majority of toxic discharges enter waterways by this route. Only a quarter of the states have set numerical water quality criteria applicable to toxic chemicals in groundwater—on which many communities depend for their water supply. It is also less than reassuring that only half the states require precautions to prevent contamination of ground or surface waters due to the rupture of hazardous waste storage containers and that only four states specify maximum time limits for storage of hazardous waste containers before disposal at an approved site (or before re-examination of the containers is required) to forestall corrosion and leakage.

Even in this era of energy shortage, only three states in ten require or encourage the proper disposal or recycling of waste lubricating oils. And little attention is being given to the proper use or disposal of the large quantities of toxic pesticides discarded as residues in unwanted pesticide containers.

What principal conclusion can be drawn from the results of NWF survey? It would have to be that there is little to prevent toxic substances disasters, as typified by the Love Canal and Kepone incidents, from happening again almost anywhere in the United States.

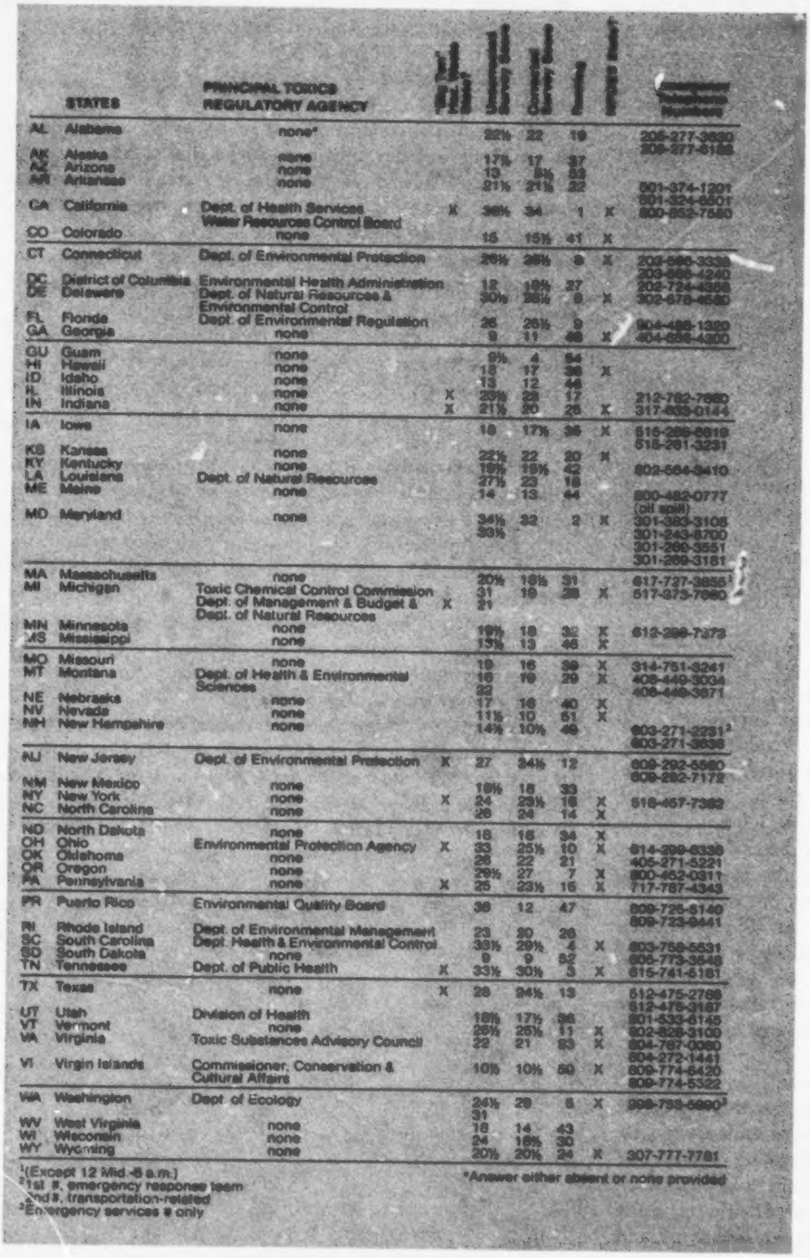
There are some hopeful signs, however. Many states are actively engaged in overhauling and strengthening their toxic substances control authorities—either on their own initiative or in anticipation of new hazardous waste regulations under the Resource Conservation and Recovery Act. The Clean Water Act of 1977 and amendments to the federal pollutant discharge regulations have given new emphasis to the control of toxic water discharges.

In the final analysis, if your state fails to move far enough, quickly enough, it is up to you to let your government representatives know that more must be done—since it is you who will ultimately pay the price for toxic substances in the environment. To get an idea of toxic substances controls in your state, see Appendix IX-3.

The principal toxic substances regulatory agency, if any, for the states supplying this information (along with emergency telephone numbers for reporting toxic substances spills) is provided in Table 9-2.

For a fuller discussion of the results of the NWF toxics survey, see, Kamlet, K.S., 1979. *Toxic substances programs in U.S. states and territories: how well do they work?* (single copies available free from NWF, Box KK, 1412 16th St., N.W., Washington, D.C 20036).

Table 9-2



	STATES	PRINCIPAL TOXICS REGULATORY AGENCY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Numbers
AL	Alabama	none*		22½	22	19		205-277-3630 205-277-6188
AK	Alaska	none		17½	17	37		
AZ	Arizona	none		13	9½	53		
AR	Arkansas	none		21½	21½	22		501-374-1201
CA	California	Dept. of Health Services Water Resources Control Board	X	36½	34	1	X	801-324-8601 800-852-7550
CO	Colorado	none		16	15½	41	X	
CT	Connecticut	Dept. of Environmental Protection		26½	26½	8	X	203-566-3338 203-566-4240
DC	District of Columbia	Environmental Health Administration		12	18½	27		202-724-4358
DE	Delaware	Dept. of Natural Resources & Environmental Control		30½	28½	6	X	302-678-4580
FL	Florida	Dept. of Environmental Regulation		26	26½	9		904-488-1320
GA	Georgia	none		9	11	48	X	404-656-4300
GU	Guam	none		9½	4	54		
HI	Hawaii	none		18	17	38	X	
ID	Idaho	none		13	12	46		
IL	Illinois	none	X	23½	28	17		212-782-7860
IN	Indiana	none	X	21½	20	25	X	317-633-0144
IA	Iowa	none		18	17½	36	X	515-281-6619 515-281-3231
KS	Kansas	none		22½	22	20	X	
KY	Kentucky	none		19½	19½	42		502-564-3410
LA	Louisiana	Dept. of Natural Resources		27½	23	18		
ME	Maine	none		14	13	44		800-482-0777 (oil spill)
MD	Maryland	none		34½ 33½	32	2	X	301-383-3106 301-243-8700 301-269-3551 301-269-3181
MA	Massachusetts	none		20½	18½	31		617-727-3856[1]
MI	Michigan	Toxic Chemical Control Commission Dept. of Management & Budget & Dept. of Natural Resources	X	31 21	19	28	X	517-373-7660
MN	Minnesota	none		19½	18	32	X	612-296-7373
MS	Mississippi	none		13½	13	46	X	
MO	Missouri	none		19	16	39	X	314-751-3241
MT	Montana	Dept. of Health & Environmental Sciences		16 22	19	29	X	406-449-3034 406-449-3671
NE	Nebraska	none		17	16	40	X	
NV	Nevada	none		11½	10	51	X	
NH	New Hampshire	none		14½	10½	49		603-271-2231[2] 603-271-3636
NJ	New Jersey	Dept. of Environmental Protection	X	27	24½	12		609-292-5560 609-292-7172
NM	New Mexico	none		18½	18	33		
NY	New York	none	X	24	23½	18	X	518-457-7362
NC	North Carolina	none		26	24	14	X	
ND	North Dakota	none		18	18	34	X	
OH	Ohio	Environmental Protection Agency	X	33	25½	10	X	614-299-6336
OK	Oklahoma	none		26	22	21		405-271-5221
OR	Oregon	none		29½	27	7	X	800-452-0311
PA	Pennsylvania	none	X	25	23½	16	X	717-787-4343
PR	Puerto Rico	Environmental Quality Board		36	12	47		809-725-5140 809-723-9441
RI	Rhode Island	Dept. of Environmental Management		23	20	26		
SC	South Carolina	Dept. Health & Environmental Control		33½	29½	4	X	803-758-5531
SD	South Dakota	none		9	9	52		605-773-3548
TN	Tennessee	Dept. of Public Health	X	33½	30½	3	X	615-741-6181
TX	Texas	none	X	28	24½	13		512-475-2766 512-475-3187
UT	Utah	Division of Health		18½	17½	36		801-533-6145
VT	Vermont	none		25½	25½	11	X	802-828-3100
VA	Virginia	Toxic Substances Advisory Council		22	21	33	X	804-787-0060 804-272-1441
VI	Virgin Islands	Commissioner, Conservation & Cultural Affairs		10½	10½	50	X	809-774-6420 809-774-5322
WA	Washington	Dept. of Ecology		24½ 31	29	5	X	206-753-6890[3]
WV	West Virginia	none		18	14	43		
WI	Wisconsin	none		24	18½	30		
WY	Wyoming	none		20½	20½	24	X	307-777-7781

[1] (Except 12 Mid.-8 a.m.)

[2] 1st #, emergency response team
2nd #, transportation-related

[3] Emergency services # only

*Answer either absent or none provided

Chapter X Summary

Right in My Own Backyard: Toxics Control at the Local Level

A citizen's best chance for positively influencing the control of toxic substances is in his/her own community. Eight steps are described for effective citizen action.

1. Choose your problem; decide what you're going to work on. Define the problem, clarify the situation, state what you would like the solution to be.

2. Find support; develop a coalition. Look for organizations with a common interest—environmental groups, sympathetic legal and technical experts, volunteers willing to use their talents and skills on behalf of something that effects them, labor unions, health professionals, public interest groups.

3. Educate yourself. Find out about your local planning process and at what points in this process citizens may be heard. Get acquainted with staff people—planners and enforcers—for land use, solid waste, and water management systems.

4. Build your case by getting information. This chapter gives advice on how to a) locate the most probable offenders, b) find out how much they actually pollute or how dangerous the pollutants are, c) check what safety measures they are using.

5. Set goals. Map out a plan of action by determining priorities, getting organized with tasks and deadlines, having regular meetings to keep the progress going.

6. Build awareness—by meetings, flyers, workshops, speaking at other organizations' meetings, newsletters, telephone networks.

7. Use the media. Get publicity for your cause through newspapers; organize marches; write a press release.

8. Seek enforcement. Call an agency's attention to a violation. Take your case to elected officials for help. Use the legislative avenues of referendum and initiative. Go to court, as a last resort.

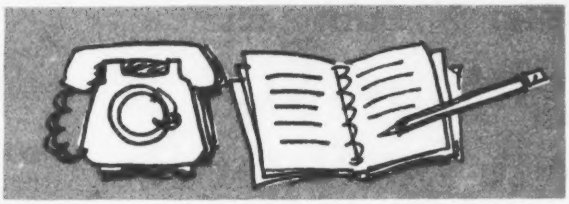
With dedication and hard work, citizen groups do achieve successes.

In Bordentown, N.J., a citizens organization—Help Our Polluted Environment (HOPE)—defeated plans to build a 2 million gallon storage farm for toxic chemicals upstream from intakes for drinking water. HOPE mobilized public reaction in the form of a referendum which led to an ordinance prohibiting bulk chemical storage in the community. HOPE also prevented a waste disposal company from starting a toxic waste disposal facility at an existing landfill in Bordentown Township.

Elsewhere in New Jersey, the Association of New Jersey Environmental Commissions (ANJEC) organized a campaign to investigate and publicize the health effects of Sevin, a pesticide spray being used extensively against gypsy moths. As a result, many communities dropped out of the spraying progress which they had previously approved.

Chapter X

Right in My Own Backyard: Toxics Control at the Local Level



At the local level, citizens need to prepare themselves to defend their communities against new threats and to clean up existing hazards. Both require a thorough knowledge of government processes and laws.

We've already talked about some of these on the federal and state levels. But your place of greatest impact will probably be local. Here is an outline for being an effective citizen activist. The steps below will be a general guide for how to proceed; many of these activities will go on concurrently.

- Choose your problem; decide what you're going to work on.
- Find support; develop a coalition.
- Educate yourself
- Build your case by getting information.
- Set goals.
- Build awareness.
- Use the media.
- Seek enforcement.

Choosing Your Problem

If you're a citizen reading this manual you may already know what you want to work on. Gathering facts and data will help define the problem and clarify the situation. It only takes one person to start, but with two or three or a group it's easier because you can divide the work and give each other moral support. Also, when asking for information initially, you can represent yourselves to an agency as a "group of concerned citizens."

As a starting point, write down (1) the problem as you now see it and (2) what you would like the outcome to be. Then as you read the rest of this section, make a list of about 10 things you plan to do first. List questions you want to answer.

It is important to be accurate and thorough in your research so that when it's time to present your case, you'll be clear and persuasive.

First on your list is to buy a notebook and keep a complete record of everything you do. Write down all names, dates, phone numbers, and information you get. Every time you have a conversation with a neighbor or official on the subject of interest, log it. You will be surprised at how often this book will come in handy.

Finding Support

You need help, so look for organizations with a common interest; you can often get information and assistance from them. How do you find them? Contact your state senator or representative, and ask for a list of state and local environmental organizations and any other state or local organizations that might have an interest in toxic pollution programs. Is there a state conservation council? Is there a multistate compact (charter approved by Congress, funded by state and Federal governments)? Are there nonprofit environmental groups such as the National Wildlife Federation (NWF), Sierra Club, or Friends of the Earth? Are there citizen action groups in the state which have already fought a battle and might be willing to act as a resource? Is there a citizens' environmental clearinghouse in the state?

Also, for every state there is a municipal league (usually in the capital) which can at least act as a referral service. The NWF has a *Conservation Directory* listing conservation organizations by state; it spells out the purpose and lists the staff of each organization.

Look for umbrella groups. Coalitions are sometimes formed from representatives of citizens associations for the express purpose of dealing with specific environmental issues.

Evaluate the membership services organizations might provide (e.g., technical or legal advice, publications, mailing lists, etc.); such groups usually have limited resources. But you may be able to get just the technical advice you need for free, by knowing where to look for it.

Are there experts in these organizations, or in the community, or in a university who can review technical reports and help you understand them? An expert can also help you decide which questions to ask about the reports. If you're going to ask the questions, you'll really have to study and know what you're talking about.

Enlist people's interest and help by talking to everyone you know every chance you get. Organize friends and neighbors—people with children, people who live along a creek—depending on the issue.

Strong effective organizations are built by having dedicated workers and experts as members. At the beginning you will identify all people interested in your topic. Throughout your work, you will need to continue to attract to your cause all types of volunteers with different skills—land use planners, sanitary engineers, lawyers, photographers, biologists, chemists, graphic artists, typists, physicians, writers/editors, trainers. You may know some of these people from other volunteer activities in which you've been involved. Mothers of school-age children may have expertise to volunteer or may be willing to attend daytime meetings regularly—and they'll soon be experts on an agency or issue.

Labor unions are interested in improving the health and safety conditions of employees in the workplace. They might even be persuaded to have members gather information on what chemical substances workers are exposed to, how often they are exposed, and what adverse health effects have been observed. This information would not only help you, but the union could use it at the bargaining table to improve conditions.

Health professionals have a continuing interest in the welfare of the community. Doctors and nurses may be reached by giving talks to professionals. Information you share with them can start them thinking and create feedback.

Look for local organizations with an environmental focus—a coalition of citizens associations, a nature organization. Go to the PTA's and board meetings of local churches. Visit civic organizations like the Chamber of Commerce, League of Women Voters, Scouts, citizen associations. Contact community and neighborhood organizations—especially those near polluting industries.

Find out if there are commercial and professional associations—fisherman, chemists, biologists—in your area. A nearby university may have a list of professional groups with local contacts. Also, ask if there is a Public Interest Research Group (PIRG) or other public interest law group in the area.

Money

Just a word about money. Volunteers will probably have to foot most of their own bills. You may want to have a couple of fund-raisers to pay for special expenses—trips to the state capital, field trips to polluting sites, very large mailings, or legal expenses. Mostly, you'll use so much time and energy on the issues there will be little left for raising money. Legal expenses may be offset by getting volunteer help—from an attorney with political aspirations, or from a law firm that does public interest work, or from an attorney who happens to live in the affected area.

Educating Yourself

The planning process

One way to solve the toxics problem you've identified is through established planning programs in your area. So find out how the planning process works, and how citizen participation can influence this process. It also means getting a background in the technical facts.

Municipalities and counties each have their unique way of operating. (In home rule states most land use decisions are made on the local level.) Plan to spend a lot of time—first on the phone and then in person—finding out how your locality works.

If you don't know where to start, call the chief executive's office (either county or city) and find out:

How are decisions made about planning and zoning, solid waste disposal, and sewage treatment? If there are boards or offices, get names and numbers. Call each office. Ask questions and see if there is printed information they can send describing their offices and programs.

If you look under county or city government in the telephone directory, the types of agencies to look for are ones with titles such as Environmental Protection, Water Resources, Solid Waste, Water Management, Sanitary Commission, Public Health. Sometimes a department (such as environmental protection) authorizes water permits; sometimes this permit function is decentralized and several departments handle a small part of the whole. Is there any coordination of efforts or information?

What do the planning and zoning boards do and how do they do it? What is citizen involvement in the planning and zoning process? Do special zoning exceptions have specific development criteria which citizens can veto? Are there master plans? What are they based on?

How are decisions made concerning solid waste disposal and sewage treatment? What system is used now? What is planned for the future? Who decides what legislation is needed? How is it passed? What part do citizens play in this process? How is urban runoff handled?

While you're finding out how these systems work, start getting acquainted with the staff—both planners and enforcers. Most people in the bureaucracy are well-motivated and will go out of their way to be helpful—some won't. Regardless, you do have the right to be informed. And you'll probably realize before long that you know more about what's going on in the overall picture than most of them do.

There are a couple of other programs you may want to learn about—coastal zone management (if you live in a coastal state), and 208 planning.

Coastal zone management comes under the National Oceanic and Atmospheric Administration (NOAA) in the U.S. Department of Commerce. NOAA has delegated this responsibility to the states and some of them are handling it on a sectional basis.

Is there a management plan to protect the coastal waters in your area? Does it determine *how* the land will be developed, or does it assume development will take place and simply control *where* the buildings will be placed? Who makes the decisions? What part can citizens play?

Where in your local, regional, or state government is the 208 planning process located? 208 planning, sometimes called water quality management planning, is required under Section 208 of the Federal Water Pollution Control Act of 1972. This planning is being carried out by every state and by an additional 176 specially designated areas. The name and phone number of every 208 agency is listed the *Water Quality Management Directory*, published by the Office of Water and Waste Management, U.S. Environmental Protection Agency, Washington, D.C.

A booklet to help you understand the 208 planning process is "Setting the Course for Clean Water," National Wildlife Federation, 1412 16th Street, N.W., Wash., D.C. 20036. One copy is free; additional copies are $2 each.

The original purpose of 208 planning was to identify all sources of water pollution within the planning area, determine the seriousness of the pollution from these sources, and develop means to control each type of pollution. Many plans have a section dealing with toxic substances in the water. Find out where you can see a copy of the plan for your area. Is there a summary of the plan? Who is responsible for making sure the plan is carried out?

These plans must be updated annually. Every year citizens have an opportunity to help change the focus of the planning process. What is the schedule for review of this plan in your area? What would you like to see changed or emphasized? How do citizens get invited to participate in the review? What has to be done to get ready for the review?

If you don't know, find out how your local government is administered. Is there a town or county council? Is there a chief executive—elected or appointed? How are rules, ordinances, statutes passed? Who carries them out?

In some circumstances legislative action may be the only way to push changes. If you want to know more about lobbying, you might read "Making an Issue of It: The Campaign Handbook," Publication No. 613, League of Women Voters, 1730 M Street N.W., Washington, D.C. (75 cents per single copy; 50 cents for handling).

During the first stages of informing yourself, it's a good idea to attend every meeting that is in any way related to the issue you're interested in. You will get to know officials and become known to them. It's a good way to screen the bureaucracy for those who seem most action-oriented and experienced.

Many meetings don't allow citizens to participate in discussions—but you can still attend to monitor what is going on. Then you can talk to officials to find out more of what you want to know and to make your own wishes known.

Public Hearings

Usually the planning process involves public hearings. These may be publicized by notices in newspapers and by sending announcements to names on a mailing list. As you visit or call councils or agencies, check for such a list and ask that your name be added if they handle activities in your area of interest.

Also, you will need to set up a system for checking every newspaper in your county for public hearing notices. If an issue is localized, there may be notices only in community newspapers that circulate in the immediately affected area. If it's a county issue, then the notice will most likely be found in a newspaper with county-wide circulation.

Check the hearing notice for information on where copies of the material to be discussed can be examined in advance. If it doesn't say, call the office which has scheduled the hearing and find out. If you want to participate in any of these hearings, you may have to notify the hearing office in advance. This may be necessary in order for them to determine how long the hearing needs to be. Sometimes, because of the interest in a particular issue, participation is limited to a certain number of minutes per person or group.

Find out what rules different agencies must follow for giving notice of a hearing. Sometimes, if these rules are not followed closely (such as sending out public notice at least 30 days in advance) any action resulting from the hearing might be declared illegal if challenged. And the whole hearing process would have to be repeated.

Who's In Charge?

Now that you know how the various agencies operate, you'll want to find out what regulations governing water pollution and toxic substance control are already on the books and how they are being used. Check for county and state annotated codes which contain all the laws on land use. Check with your county agencies for ordinances and regulations governing their actions in the areas of water and toxic pollution. Call your state legislative representative and ask for a list of local ordinances and state laws governing toxics and water pollution.

While you're at it you can double-check the information you've collected by asking for a list of state and local offices that have any kind of enforcement responsibility where toxics and water are concerned. Get names, addresses, phone numbers.

Permits concerning water usage are generally issued in accordance with set rules and regulations. For example, at the state level, a department of health or a department of environmental protection monitors and tests water quality and issues permits for wells and septic tanks.

What can your municipal and county boards of health do? They often have a wide range of powers to deal with nuisances, but may not use them unless pushed.

Does your state have a department of natural resources? Who has responsibility for all the waters of the state (including stream beds and underground aquifers)? Does everyone seeking a permit have to go through an approval process—public notification, hearing, etc.? Are there exceptions to this process? What are they? What about State laws? What do they say? Are they enforced? Do an inventory of your State using information in Chapter IX as a starting point.

Other questions you may need to answer: Who knows what's in that stream? How do I find out? When was it last monitored? Has it met a compliance schedule?

Building Your Case

Locating the most probable offenders

How do you spot problem dischargers? It's easy to identify the ones that produce gross effects—people or animals get sick, there is a bad smell, fish die. But less dramatic poisoning is going on, too.

If you live in an industrialized community you may want to identify the most likely polluters. A simple check is to look at the lists of high-risk industries in Tables 7-1, 7-2, and 7-3. Are there any of these in your immediate community?

If your aim is to help clean up an entire river, stream, or stream segment, or to pinpoint the most probable offenders in a particular segment, then you may want to adapt the New Jersey case study approach as described in Chapter *VII.*

Identifying possible offenders may seem difficult and time-consuming but it will be easy compared to finding out how much these industries actually pollute, or how dangerous the pollutants are.

One source of help may be university chemistry and biology departments. Can these experts tell you what toxic chemicals are a by-product of different manufacturing processes? Can they help you test water samples for any of these, or for levels of pesticides in runoff, or for toxics in drainage from mines?

As you learn how various agencies work you will probably hear references to water samplings. These are samplings taken from water, bottom sediments, and organisms to determine what's there. Are the desired water samplings being done in your area? Could they be done? By whom? Who monitors groundwater in the area of a chemical dump? Who monitors wastewater discharges of the industries you are checking into? Is there any court action now pending against any of these industries? Do they have a permit to discharge? Check this with U.S. EPA.

If they do have a permit, get actual copies of the NPDES permits and the permit applications from U.S. EPA. What do the industries say they are discharging and at what rate? Do you suspect discrepancies? Can you get a state environmental protection inspector to check the discharge? How can you initiate a review of the NPDES permit?

Circulate a suspected offender list to citizens and request help and information from anyone reading the list. Caution needs to be exercised here. You need to be factual to avoid the possibility of libel prosecution.

Talk to local health officials or check medical records—has there been a pattern of sickness or birth defects? Or have they received any complaints?

If you can arrange a visit to the plant itself, do so; take experts with you. Who has the right to inspect the plant? Is there evidence of misuse or mishandling of chemicals? Does the plant pretreat wastewaters discharged into the sewer system? How? Is the process adequate? Are hazardous wastes disposed of on- or off-site?

If you can't visit, will workers talk candidly with you after working hours? Do you have friends, or friends of friends who work for the company? Is there a local bar that employees frequent after work? Do these workers suffer from any unusual health symptoms? Can you enlist their powers of observation? If the industry is very important economically in the community, be prepared for the fact that many people are reluctant to talk about problems which might cause it to close.

How do you spot problem dischargers? It's easy to identify the ones that produce gross effects—foliage dies, there is a bad smell, fish die. But less dramatic poisoning is going on too. Credit: Al Pfeiffer, N.J. PIRG

Use libraries to check back issues of newspapers for obituaries and retirement notices. Go back several years. How many of these people worked for suspected companies? For how long? How old were they at death or retirement? What was the cause of death? If listed as "cancer" can you check with family or friends of the deceased to see what kind of cancer? What does your health department say about this? Do any of the early retirees still live in the community? If so, can you talk to them and find out why they retired? Was it disability? Do they know of anyone else who retired early? Where are they now?

Again, you may be able to use your local college or university in this process. Can students investigate certain aspects of the environment as a project for a class or for an organization? Are there statisticians—professors or students—who will determine significance of your data?

Also, can you find out what an industry's total budget is and how much of this budget is spent in pollution control? How does it compare with similar industries? This might come from business sections of newspapers or annual reports.

Read the newspapers regularly; clip and file pertinent information.

Setting Goals

You may have started your fact-finding process with a suspicion. Now that you've gotten part of the case built up and people are becoming interested, meet and make plans.

Review all the data, redefine the problem, and decide what to do about it. It might be a simple decision—clean up the stream, for example. But to accomplish an overall goal requires many steps. Using the information you have, map out a plan of action. Have those who will be responsible for various jobs set their own deadlines. Set another meeting to check-in, check-up. As soon as you have a case, an important task will be building public interest and support.

Determining Priorities

There is usually no problem in setting the big priority, such as cleaning up the stream. The problem may be in agreeing on actions to accomplish this. Which is more important, a moratorium on sewers so the problem won't get worse, or installing bigger sewer pipes to prevent overflow?

Plan a meeting specifically to set priorities and assign jobs. If you have a large meeting and there are too many people for each person to be heard individually, you may want to split the meeting into workgroups of 7 to 10 people.

Each group lists the actions they think are important. (Have one person in each group take notes.) Then, still in the workgroups, they number their list in order of importance.

Another method is to hand out a sheet listing possible actions mentioned in earlier meetings; the groups can work from these sheets and number what they think is most important and least important.

Whichever method is used, have the notetaker from each group report that group's top priorities and write them on a blackboard or easel as a master list. You will see agreement and disagreement and will have narrowed the list. You can either go back into work groups—this time with different people—and choose a new set of priorities from the master list, or using the master list as a guide, you can determine priorities by voting.

When priorities are set, citizens select what they want to work on, meet briefly with other interested persons to organize their "committee," and set a time and place for the committee's first meetings. By accepting responsibility for certain jobs and setting dates for completion, citizens will be more motiviated to meet their self-imposed deadlines.

Getting the Job Done

Make sure there are ways for each committee to check in (probably at scheduled meetings) and that there is a coordinator to check up, in case anyone needs words of encouragement or physical help in accomplishing tasks.

Have frequent network meetings in the beginning so if one part of the action bogs down it can get help and get moving again. With the resources and moral support of the whole group, it is easier to become reinspired.

To build a strong organization, it is important that each person be recognized for work done. This might be in the form of private praise and a pat on the back, or in acknowledging that person in front of the group.

To make meetings run smoother, post an agenda at the beginning of each one, ask for additions, and assign the amount of time each item will take so the meeting keeps moving. Have an agreement in advance as to when the meeting will end (and try to stick to that deadline). Make sure you allow for input from participants so everyone feels involved. Be willing to discuss and adapt the original strategy to keep the action moving.

The image your group wants to project is important and needs to be discussed. There may be groups you will not want as part of your coalition because of the community image they already have. You will want to appear as a responsible group of citizens concerned about the welfare of yourselves and the community at large. When you talk to officials you want to appear knowledgeable and you want your information to be reliable. If your group can appoint one or two "official spokespersons" (even if no one has the title) it will help in dealing with the media later.

If you can, think of a name for your coalition with initials that form a word itself (an acronym) and is not already in use; people will recognize it faster as it is publicized. However, it's better to have a name that really says who you are than a phony one which means nothing.

Building Awareness

Building awareness is a matter of educating people. When an active group of citizens has the overall picture, the next step is to share this with others. Talk to everyone you meet. Write down questions you can't answer and points others make which seem to "weaken" your case. This will show where you need more work.

If there is an immediate threat to the neighborhood, talk to everyone you know, explain the situation, ask them to attend a meeting, which you will have already scheduled. You may also want to send or deliver flyers to every house in the surrounding area to inform residents of a proposed threat and to invite them to a meeting where it will be discussed. Handing out flyers outside a local supermarket (check with the store first), posting an eye-catching notice on a community bulletin board, and getting a meeting notice in the community newspaper are other ways to bolster attendance.

If it is not an emergency, you can plan a workshop to educate people and publicize your cause. The techniques mentioned in the above paragraph can be used to encourage attendance. At the workshop explain the situation; discuss possible consequences of action (and inaction). See if you can get press coverage or have someone in your group write the highlights in an interesting, newsworthy style and submit them to the local paper.

If the workshop includes a question-answer period, make sure you arrange with people in the audience are prepared to ask questions covering issues that don't come up naturally.

Alternatives to workshops are teach-ins in cooperation with a secondary school or a university; "talk shows" on local television and radio stations willing to discuss your issue, and speaking engagements at meetings of local organizations. At such events, after you have shared your findings and explained what you hope to do about it, pass a sign-up sheet for interested citizens to list name, address, phone number. Ask the organization to vote its support for your cause. See if you can get a commitment from an officer or two to go with you to future meetings with officials. Then you can introduce yourselves as a citizen's coalition, represented by officers of the organizations, and thus have more clout.

If there is more of a demand for your presentation than you can fill, start a speaker's bureau. You can offer single speakers or a panel.

Contact all the people who sign your sheet when you visit an organization—within the next day or two by phone. Explore with them their interest and what they might want to contribute—time, talent, money.

Networking

Networking is a term for creating ties among diverse groups, and keeping these groups informed of the overall picture. In a coalition, information has to pass through at least two levels—representatives, then the organizations they represent. Some form of communication—newsletter, telephone—is vital to an effective network.

If your group starts a newsletter, how will its production be paid for? Will you distribute it door-to-door, mail it, or have a central pick-up point (such as the local library or dairy store)? Do you have volunteers who would be responsible for this?

Can you get free space for a weekly or monthly column in a community newspaper? Do you have someone who could write an interesting, informative piece and would be responsible for doing it regularly? Are you willing to consider both sides of the issue? Would you be able to use this column to notify members of meetings, hearings, etc.?

If you start a telephone network you can notify lots of people in a short time. Are there responsible people near the bottom of the pyramid? (For example, by having one person call five people, then having each of these five call five more you can notify 130 people quickly. However, if one of those first five fails to make the calls, that's 25 people who don't get the message.)

Another technique of networking is to gradually involve organizations in your campaign. After you appear at each of their meetings, call the president and ask if the group would like to send a representative to your coalition meetings. Keep these representatives—and thus their organizations—informed with news bulletins by one of the ways mentioned above. When help is needed, ask the representatives if they would be willing to accept a task.

Using the Media

Is there someone in your group with professional editing/writing experience? If so, are they willing to help plan a publicity campaign, write press releases, and serve as the media contact person?

If you don't have professional help, remember you're doing newspapers and T.V. and radio stations a favor by furnishing them with newsworthy items. One way they stay in business is by reporting the news.

You probably already know what media exist in your community; if not, check the yellow pages. Visit a couple of newstands and find out what's available and when and where it's published.

Press coverage is most effectively obtained by one-to-one contact. If one or two people take it upon themselves to personally deliver press releases (or pictures) and stand there until the appropriate editor has a chance to look them over and ask questions, the citizens' view is much more likely to be understood and publicized. Also, you're building a rapport with the editorial people and they begin to think of you as the expert to call when they need information. While you're there describe your cause and ask for suggestions of ways to publicize it. (You may or may not want to use the suggestions.)

Small local radio and T.V. stations often need good public interest information. They might consider a specialist/citizen debate, a panel discussion, or a free-wheeling talk show with a question and answer format. Do they do documentaries? What's their policy on continuing coverage of news and publicity events? Do they do public service announcements?

Chances are, if your efforts are based on solid ground, you won't have to fight for attention. Even so, it's often helpful to illustrate a point. An example would be a photograph taken to show a playground with a proposed chemical dump site in the background. Another example would be a citizens' march (invite the media to walk along) to illustrate exactly what is proposed. Furnish marchers with signs to add to the visual effect. Just be careful not to trespass on private property without permission.

Arrange handouts to media people at the time of the march. These should give full background information. Explain how investigations were conducted, how conclusions were reached, what channels of responsibility have been exhausted, and who from which government agency is working on the problem, etc. Furnish the name of the person serving as the "official spokesperson" for the group so reporters can credit their information to a source.

For those television and radio stations not represented at the event, call in the information in time for the next news broadcast.

For newspapers not attending, arrange with a professional photographer (maybe someone in your group) to take pictures and deliver a picture and a press release in time for publication.

Understanding How a Newspaper Works

Large circulation newspapers are often organized by area. Who covers your area? Does that reporter have discretion in deciding what to cover in the area? Or does an assignments editor do that job? Photographers are separate from writers. They are assigned jobs (usually several in one day). Who makes the assignments? How far in advance must editorial and photo requests be made? What are the deadlines for press releases and for reporters' and photographers' material?

Small newspapers may have a full-time staff or may use freelance people or "stringers." (Stringers may work for more than one publication in an area. If you find out who they are and include them in your contacts, it can expand your coverage—perhaps to a state or national level.) If there is a full-time staff, is the reporter also the photographer? Is that person also the editor? What are the paper's deadlines-these differ a lot between weeklies and dailies.

You may find that small papers are more responsive to citizens than large ones which cover a wide area. Being on the front page of a small local paper can mean a lot more to your cause than a two paragraph blurb buried in the middle of a larger one.

What are the editorial policies of the papers? Who writes the editorials? Who determines official editorial policy? Is there such a thing as guest editorials? or guest columns?

The same fact-sheets you use as background information can be used in an attempt to get editorial comment. Present *all* the facts. It will make your case stronger if you can refute what the opposition is saying. If you can't get someone on the paper to write an editorial you can still write a letter to the editor. Letters to the editor are widely read and can sometimes have an even greater impact than a news story.

If you have a graphic artist in your organization, would that person be willing to furnish a timely cartoon free of charge? Make sure you have an understanding with the newspaper in advance what the cartoon will be about and that it will be printed; otherwise the artist could waste a lot of time. Small community newspapers are best for this approach.

When reporters and editors do a good job, make sure you show your appreciation. Call and thank them personally—good for their egos and your future treatment. Or write a letter to the editor commending a news story, an editorial stance, or a timely cartoon. On the other hand, if you're unhappy with the coverage, call or write and ask for more complete coverage in the future.

When there are favorable newspaper articles, editorials, or letters to the editor, clip, reproduce, and distribute them to build awareness.

Writing a Press Release

Press release is simply a term for a written statement about your activities which you "release" to the media. Releases need to be timely. Last week's news just won't make today's daily paper—unless it is reworked and updated.

Papers prefer to publicize meetings in advance unless they are controversial or particularly interesting. (And in that case they may choose to send a reporter or photographer.) To take advantage of advance publicity, be sure to meet any deadlines.

Set up your release like this:

PRESS RELEASE

Contact: *(name)*
(phone number)

For release: *(time of day and date)*

(Body of release giving who, what, when, where, why in first one or two paragraphs.)

Help Our Polluted Environment (HOPE) will meet Friday (June 20), at 8 p.m., at the Cabin Glen Town Hall to set priorities in their campaign to clean up the Cabin Glen Creek. For more information call Jane Smith at (telephone number).

For a simple meeting notice, this is all that's needed. If the meeting will be controversial, or if there will be a speaker, outline the issues to be discussed or the background of the speaker.

After the meeting submit another release describing what happened. (Sometimes, depending on the importance of the meeting, you can arrange in advance with a reporter to call in details of the meeting instead of issuing a release.)

When you write a more detailed release, be sure to set the story up so that the most important facts come first. In the middle of producing a newspaper when time is short and a story is long, the editor will usually cut as much off the bottom of the story as is needed to make it fit. Also, credit any statements to a source so that it doesn't sound like the newspaper is saying it. After you write a release, have someone else read it. If any section has to be read more than once to get the meaning. It needs rewriting.

Each paper has its own style. Compare your original release with the printed story. How does it compare? Are there errors in the story because you weren't clear?

Small newspapers, with their limited staff, tend to print press releases almost as they come across the desk—providing they are well-written and don't seem too radical.

Holding a Press Conference

Press conferences are reserved for special occasions, when there is something important or new to announce. Don't use them too often or they'll lose their punch. At the press conference distribute packets containing background information sheets, press releases, and perhaps a photo. Make the press releases *very short* for radio and T.V.; longer for newspapers. For the conference, make sure you know all the facts on your opposition's side and decide in advance how you're going to handle "iffy" issues.

Pushing Enforcement

It is really true that the squeaky wheel gets the grease. If there is a particular trouble spot, bring it to the attention of the proper enforcement authorities and politicians and keep the pressure on.

In some instances involving flagrant violation of the law, the steps to enforcement are straightforward—you simply insist that it take place through the appropriate agency.

In other instances enforcement may be practically impossible and only a public outcry will put a stop to the pollution. An example would be a registered disposal site where haulers of toxic wastes unload. There may be such a back-up of wastes waiting to be processed that the temporary storage facilities are not safe for the long-term storage which is required. What are the viable alternatives?

One way to get something enforced that's being ignored is to work with the people who should be doing the enforcement. Go in reasonable, genteel, but firm. Start as high up in the agency as possible. This person may actually not know that enforcement is not taking place, or is supposed to take place. Most officials are conscientious and want to do a good job; sometimes all they need is the support which you can provide in getting their job done. Other times determining new policy and implementing new or old programs is not done voluntarily by an agency so you will need additional pressure from the outside.

As you work, make yourself known to state, local, and federal elected officials. Most of your work with legislators will be done on the state and local level. Be sure they identify you with your cause—talk to them about it at every opportunity. If you weren't involved in their campaigns, find someone who was and knows them personally. Have that person arrange the first meeting and go with you to present your case.

If you don't have a contact, go ahead and call. Request a personal meeting in the legislator's office, or ask that the legislator attend a citizens meeting.

Have your case well organized. Present a responsible statement with as many responsible groups as possible supporting it. Again, this broad-based support is shown by having presidents (or other officers) of involved organizations with you when you make the presentation, or by having them sign a statement of support.

If your concern focuses on citizens vs. government, you can ask elected officials to be the intermediary. They may need time to verify the facts. You can also ask them for short-range advice on the most effective ways to handle situations.

To back up your meeting have several people call or write. But don't apply too much pressure because you're trying to establish a good working relationship and don't want to be a pest—just persistent.

A responsible legislator will always check out a situation and get back to the citizen who calls—legislators get reelected by being responsive to citizens.

Keep checking with your legislators to see if there are any results such as (a) legislation drafted, (b) enforcement taking place in the responsible department.

By enlisting the cooperation of legislators and staying in touch with them, the responsible agency will be getting pressured by both politicians and citizens. This may be enough to cause enforcement.

A word of caution. Never threaten a legislator with loss of votes. This is a big turn-off and is a sure sign of the amateur. Another turn-off is pushy insistence by calling at inconvenient or inconsiderate times—such as the dinner hour or 2 a.m.

If you find public officials, administrators, or legislators are not too responsive and seem to be supporting industry, about all you can do is keep up public heat and interest until they decide it is politically prudent to pay attention.

The last resort for a citizens group is the courts. It's expensive for private citizens. However, if your quarrel is with the government and construction is involved, it can be expensive for them too. Construction costs continue to rise as long as the situation is tied up. *See*, the end of Chapter V for further discussion of litigation.

In addition to using administrative and judicial channels to push enforcement, you can use the legislative process—referendum and initiative. A referendum on the local and state level can call into question any laws the legislature has passed within a certain period. Initiative is used to get public response to issues the legislature hasn't dealt with. Both can change actual laws and are done by using petitions to bring the issue to the attention of lawmakers.

In dealing with environmental issues, it is up to the citizen to have a creative total picture because bureaucrats won't—and can't—have the same overall view that you do. You can consider all the alternatives whereas the bureaucrat may be stuck with an established policy and may not have the will or way to allow for alternative thinking.

Getting something changed is a lot of work, a lot of fun, and you learn a lot. There's also a deep satisfaction. Here are two examples of how citizens made a difference.

Can the Citizen Win? Two Success Stories

A Chemical Storage Farm and a Chemical Dump

Rick and Kathy Gimello live in Bordentown, N.J. This community of about 12,000 people furnishes the Trenton area with white collar workers—engineers, scientists, chemists. During a four-year period, Help our Polluted Environment (HOPE)—an organization founded by the Gimellos—grew from six to 350 people. HOPE enlisted the help of Bordentown's white collar experts to defeat two major environmental threats to the community; both involved toxic pollutants.

In 1975 Dow Chemical Company proposed building a 52-acre storage farm which would have 63 tanks each capable of holding 2 million gallons of, as Rick puts it, "some of the most dangerous substances around"—perchloroethylene, trichloroethylene, and carbon tetrachloride, to name a few.

It was shown that the proposed storage farm was upstream from four drinking water intakes for the city of Philadelphia and less than 2 miles from the Torresdale, Pa., drinking water intake. In addition, 50 to 60 tons of hydrocarbons would be released into the atmosphere each year and raw materials would probably arrive by barge and rail and leave by truck—right through the town. In spite of this, politicians supported the project because of the large contribution it would make to the tax rolls.

Citizens first carried out extensive telephone and petitioning campaigns which showed overwhelming opposition to the project. The Town Council refused to accept the citizens' findings as valid. In response, HOPE asked what method could be used to convince the Council that citizens were really against the storage farm. As a result, a non-binding referendum was carried out in the spring of 1978 and 1,500 people—more than in any gubernatorial election—turned out. The proposal was defeated two to one, and ordinance was drawn up prohibiting bulk chemical storage in the community.

At about the time this first threat to the community was defeated, the group saw an environmental impact statement issued by Earthline, Inc.—a subsidiary of SCA (Service Corporation of America)–a large waste disposal company based in Boston, Mass. Earthline wanted to start a toxic waste disposal facility at an existing landfill in Bordentown Township.

After HOPE's experts reviewed the statement, the group had 3 months to prepare for the public hearing. During investigation, HOPE discovered that SCA had literally been kicked out of Wilsonville, Ill., by a judge because the company's operating procedures had been so bad. After only a year's operation in Wilsonville, leakage was migrating 2 miles from the toxic waste disposal site.

HOPE also discovered that it had been an SCA practice to obtain a regular landfill permit, operate the fill for a while, then convert it to a toxic waste disposal site. In addition, a possible conflict of interest was found involving the head of the state solid waste administration and an SCA attorney. The solid waste administration is a division in the New Jersey Department of Environmental Protection (DEP).

At the time of the hearing, HOPE had $2,000 in its "war chest" and used it to fly witnesses in from Wilsonville (the state assistant attorney general and the state engineer) and from Love Canal, N.Y. (a councilwoman and a group of residents). During the 2-day, 13-½ hour hearing, 60 people testified; the only ones in favor of the project were SCA representatives. New Jersey DEP issued a denial order in the summer of 1979 effectively killing the project.

The good works of HOPE have not stopped there. Members have remained active as a resource to help surrounding communities deal with their own environmental problems.

A Massive Chemical Spraying

The Gimellos showed how two concerned citizens can organize a group and fight unwanted pollution. An example of how a few citizens can act through an existing organization to influence government decisions is exemplified by an effort of the Association of New Jersey Environmental Commissions (ANJEC).

In the winter of 1978-79, ANJEC organized a campaign to find out about and publicize the health effects of a spray used extensively against gypsy moths.

Spraying for gypsy moths has been almost routine throughout the state of New Jersey for close to a decade. In past years individual towns, subsidized by state and Federal governments, have sprayed Sevin (carbary1), a chemical manufactured by Union Carbide.

Each year each town must pass a resolution declaring the gypsy moth to be a public enemy and giving approval to participate in the program. Before 1978 approval for the spraying was pretty much routine; some minor opposition had occurred, usually too late to be effective.

Gradually citizens in northern New Jersey began to question the health effects of massive spraying with carbaryl. They had heard of studies showing the chemical to be toxic to the fetuses of animals. Citizens asked for meetings specifically to explore these health effects and a series of them were held by the N.J. Department of Agriculture.

John Wilson, active in ANJEC, attended the one in Morris County. "The meeting was marked by the absence of a discussion of health," says John. "Although packets of materials were distributed at the meeting, only one piece of literature discussed health effects and it downplayed them." Upon questioning, it was found that the pamphlet was written by Union Carbide. The answer given to questions about possible health effects was that the pesticide was registered by the EPA for the designated use and thus considered safe.

Most of the discussion was about the Integrated Pest Management (IPM) control program run by the state Department of Agriculture. This program uses knowledge of the gypsy moth's life cycle in order to control it (e.g. introducing sterile males to reduce the breeding population of the moth or using internal pest hormones to disrupt its life cycle).

In a true IPM program, chemical sprays are used only as a last resort. Because Sevin was being used in many areas as a first resort, some citizens felt that it was killing the good bugs as well as the bad ones and might be defeating the purpose of the IPM program.

Many people favored spraying; they were afraid trees would be defoliated or killed by the moths. Tree mortality, in areas where the moths are a problem, is low among healthy trees and high among unhealthy trees, but defoliation is common. "It was a very mixed and emotional issue," said John, "with the prospraying voices being stronger."

After the special educational seminars, ANJEC concluded there was a lack of good health information and decided to research the issues and to serve as a resource for local officials in their decision making.

Three people working part-time uncovered studies indicating carbaryl has produced teratogenic (causing birth defects) and fetotoxic (harmful to fetuses) effects in dogs and pigs.

When ANJEC tried to get someone in EPA to take a position for or against the pesticide, they were repeatedly frustrated. "Finally someone just decided to give us a letter," said John, "It was from EPA's director of Pesticides and Toxic Substances Enforcement Division in Washington, D.C., and was written to the chief of the Massachusetts insect pest control program in that state's Department of Forests and Parks.

The letter was written in response to a question as to whether it is legal to apply Sevin aerially. The letter said that Sevin was under review by the EPA with the idea that its registration might possibly be changed or revoked, and that this was being done in light of results shown by published animal studies.

ANJEC studied the alternatives and suggested using *Bacillus thuringiensis,* commonly known as B.t. B.t. is a bacteria spray that gives the gypsy moth a severe stomach ache while it eats and it then starves to death. The bacteria has not been found to attack other types of animals, except for some moths and butterflies, and has no effect on honeybees. There could be allergic responses by a small number of people to the toxin produced by the bacteria. Also, the timing for its use is critical to its success.

"Our role was to get out all the information—the benefits and side effects of spraying with Sevin, and the alternatives. We distributed information widely," said John.

Some citizens felt their towns had been missurveyed when, during the previous winter, gypsy moth egg cases had been counted and calculations of possible infestations made. Members of ANJEC went out and resurveyed. They consistently found that towns had been overzealous in their calculations and worked to convince town councils not to participate in the program.

In Morris County, John Wilson's home county, 14 of the 17 towns dropped out of the spraying program.

"The key," says John "was getting people informed. For once citizens made an attempt to get the facts. They looked up the studies and talked to people. Once the information was out, the decision not to spray was not that difficult. But citizens cannot afford to rest on past laurels. The manufacturer is still eager to sell its product. Some alternatives to the spraying cost more and take more time. It is up to the citizens to stay on top of what's happening."

Conclusion

Any person who wants to have a part in determining how toxic substances will affect his life, and those of his children and fellow humans, will certainly ask himself a hard question: what can I really do?

The realities are serious.

It's hard work getting information, getting support, getting action. But it can be done.

Often it is more productive to make an impact on the planning process than to fight a situation that's already bad. It's easier for administrators and legislators to listen before things are underway than after.

The possibilities are there, too. Citizen efforts do succeed—frequently enough to keep the faith burning.

You can do it. This handbook is one tool. Your own determination is another. We wish you success.

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Appendix II

II-1 Priority Toxic Pollutants

1. *acenaphthene
2. *acrolein
3. *acrylonitrile
4. *benzene
5. *benzidine
6. *Carbon tetrachloride (tetrachlormethane)

***chlorinated benzenes** (other than dichlorobenzenes):

7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene

***chlorinated ethanes** (including 1,2,-dichloroethane, 1,1,1-trichloroethane and hexachloroethane):

10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane

***chloroalkyl ethers** (chloromethyl, chloroethyl and mixed ethers):

17. bis (choloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether (mixed)

***chlorinated naphthalene:**

20. 2-chloronaphthalene

***chlorinated phenols** (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols):

21. 2,4,6-trichlorophenol
22. parachlorometa cresol
23. *chloroform (trichloromethane).
24. *2-chlorophenol

***dichlorobenzenes:**

25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3-dichlorobenzidine

***dichloroethylenes** (1,1-dichloroethylene and 1,2-dichloroethylene):

29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. *2,4-dichlorophenol

***dichloropropane and dichloropropene:**

32. 1,2-dichloropropane
33. 1,2-dichloropropylene (1,3-dichloropropene)
34. *2,4-dimethylphenol

***dinitrotoluene:**

35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. *1,2-diphenylhydrazine
38. *ethylbenzene
39. *flouranthene

***Haloethers** (other than those listed elsewhere):

40. 4-chorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis (2-chloroisopropyl) ether
43. bis (2-chloroethoxy) methane

***halomethanes** (other than those listed elsewhere):

44. methylene chloride (dichloromethane)
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane
49. trichloroflouromethane
50. dichlorodiflouromethane
51. chlorodibromomethane
52. *hexachlorobutadiene
53. *hexachlorocyclopentadiene
54. *isophorone
55. *naphthalene
56. *nitrobenzene

***nitrophenols** (including 2,4-dinitrophenol and dinitrocresol):

57. 2-nitrophenol
58. 4-nitrophenol
59. *2,4-dinitrophenol
60. 4,6-dinitro-o-cresol

***nitrosamines:**

61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine

63. N-nitrosodi-n-propylamine
64. *pentachlorophenol
65. *phenol
*__phthalate esters:__
66. bis (2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate.
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
*__polynuclear aromatic hydrocarbons:__
72. benzo (a) anthracene (1,2-benzanthracene)
73. Benzo (a) pyrene (3,4-benzopyrene)
74. 3,4-benzoflouranthene
75. benzo (k) flouranthane (11,12-benzoflouranthene)
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo (ghi) perylene (1,2-benzoperylene)
80. phenathrene
81. fluroene
82. dibenzo (a,h) anthracene (1,2,5,6-dibenzanthracene)
83. indeno (1,2,3-cd) pyrene (2,3-o-phenylenepyrene)
84. pyrene
85. *tetrachlorethylene
86. *toluene
87. *trichloroethylene
88. *vinyl chloride (chloroethylene)
pesticides and metabolites:
89. *aldrin
90. *dieldrin
91. *chlordane (technical mixture & metabolites)
DDT and metabolites:
92. 4,4′-DDT
93. 4,4′-DDE (p.p′-DDX)
94. 4,4′-DDD (p.p′-TDE)
*__endosulfan and metabolites:__
95. a-endosulfan-Alpha
96. b-endosulfan-Beta
97. endosulfan sulfate
*__endrin and metabolites:__
98. endrin
99. endrin aldehyde
*__heptachlor and metabolites:__
100. heptachlor
101. heptachlor epoxide
*__hexachlorocyclohexane__ (all isomers):
102. a-BHC-Alpha
103. b-BHC-Beta
104. r-BHC (Lindane)-Gamma
105. g-BHC-Delta
*__polychlorinated biphenyls__ (PCB's)
106. PCB–1242 (Arochlor 1242)
107. PCB-1254 (Arochlor 1254)
108. PCB-1221 (Arochlor 1221)
109. PCB-1232 (Arochlor 1232)
110. PCB-1248 (Arochlor 1248)
111. PCB-1260 (Arochlor 1260)
112. PCB-1016 (Arochlor 1016)
113. *Toxaphene
114. *Antimony (Total)
115. *Arsenic (Total)
116. *Asbestos (Fibrous)
117. *Beryllium (Total)
118. *Cadmium (Total)
119. *Chromium (Total)
120. *Copper (Total)
121. *Cyanide (Total)
122. *Lead (Total)
123. *Mercury (Total)
124. *Nickel (Total)
125. *Selenium (Total)
126. *Silver (Total)
127. *Thallium (Total)
128. *Zinc (Total)
129. *2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

II-2 129 Priority Toxic Pollutants By Classes

Pollutant	Characteristics	Sources
Pesticides Generally chlorinated hydrocarbons	Readily assimilated by aquatic animals, fat soluble, concentrated through the food chain (biomagnified), persistent in soil and sediments	Direct application to farm- and forestlands, runoff from lawns and gardens, urban runoff, discharge in industrial wastewater
Polychlorinated biphenyls (PCBs) Used in electrical capacitors and transformers, paints, plastics, insecticides, other industrial products	Readily assimilated by aquatic animals, fat soluble, subject to biomagnification, persistent, chemically similar to the chlorinated hydrocarbons	Municipal and industrial waste discharges disposed of in dumps and landfills
Metals Antimony, arsenic, beryllium, cadmium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc *Other inorganics* Asbestos and cyanide	Not biodegradable, persistent in sediments, toxic in solution, subject to biomagnification *Asbestos* May cause cancer when inhaled, aquatic toxicity not well understood *Cyanide* Variably persistent, inhibits oxygen metabolism	Industrial discharges, mining activity, urban runoff, erosion of metal-rich soil, certain agricultural uses (e.g., mercury as a fungicide) *Asbestos* Manufacture and use as a retardant, roofing material, brake lining, etc.; runoff from mining *Cyanide* Wide variety of industrial uses
Halogenated aliphatics Used in fire extinguishers, refrigerants, propellants, pesticides, solvents for oils, and greases and in dry cleaning	Largest single class of "priority toxics," can cause damage to central nervous system and liver, not very persistent	Produced by chlorination of water, vaporization during use
Ethers Used mainly as solvents for polymer plastics	Potent carcinogen, aquatic toxicity and fate not well understood	Escape during production and use
Phthalate esters Used chiefly in production of polyvinyl chloride and thermoplastics as plasticizers	Common aquatic pollutant, moderately toxic but teratogenic and mutagenic properties in low concentrations; aquatic invertebrates are particularly sensitive to toxic effects; persistent; and can be biomagnified	Waste disposal vaporization during use (in nonplastics)
Monocyclic aromatics (excluding phenols, cresols and phthalates) Used in the manufacture of other chemicals, explosives, dyes and pigments, and in solvents, fungicides, and herbicides	Central nevous system depressant; can damage liver and kidneys	Enter environment during production and byproduct production states by direct volatization, wastewater
Phenols Large volume industrial compounds used chiefly as chemical intermediates in the production of synthetic polymers, dyestuffs, pigments, pesticides, and herbicides	Toxicity increases with degree of chlorination of the phenolic molecule; very low concentrations can taint fish flesh and impart objectionable odor and taste to drinking water; difficult to remove from water by conventional treatment; carcinogenic in mice	Occur naturally in fossil fuels, waste water from cooking ovens, oil refineries, tar distillation plants, herbicide manufacturing, and plastic manufacturing; can all contain phenolic compounds
Polycyclic aromatic hydrocarbons Used as dyestuffs, chemical intermediates, pesticides, herbicides, motor fuels, and oils	Carcinogenic in animals and indirectly linked to cancer in humans: most work done on air pollution; more is needed on the acquatic toxicity of these compounds; not persistent and are biodegradable though bioaccumulation can occur	Fossil fuels (use, spills, and production), incomplete combustion of hydrocarbons
Nitrosamines Used in the production of organic chemicals and rubber; patents exist on processes using these compounds.	Tests on laboratory animals have shown the nitrosamines to be some of the most potent carcinogens.	Production and use can occur spontaneously in food cooking operations

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*Specific compounds and chemical classes as listed in the consent decree.

Remarks

Several chlorinated hydrocarbon pesticides already restricted by EPA; aldrin, dieldrin, DDT, DDD, endrin, heptachlor, lindane, and chlordane

TSCA ban on production after 6/1/79 but will persist in sediments; restrictions on many freshwater fisheries as a result of PCB pollution (e.g., lower Hudson, upper Housatonic, parts of Lake Michigan)

Large volume industrial chemicals, widely dispersed, but less threat to the environment than persistent chemicals

Large volume industrial chemicals, widely dispersed, but less threat to the environment than persistent chemicals

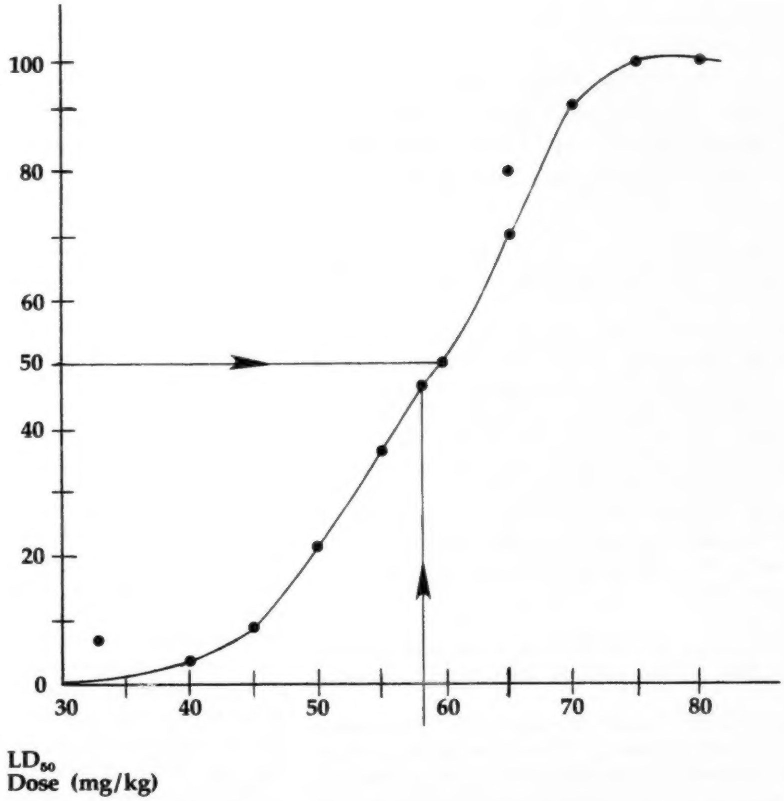
Appendix III

III-1-a LD_{50}

In practice, 50 to 100 rats are divided at random into groups of 5 to 10, each group being given a different dose level of the chemical. For each group, the number of rats which die is determined. From these results, the LD_{50} can be obtained graphically (See Figure below) which shows a hypothetical set of data demonstrating an LD_{50} of 58 mg/kg, or 58 milligrams per kilogram of body weight.

Results depend on many factors besides the chemical and animal species used, such as the age of each animal, its sex, health, and nutritional background; the way and medium in which the chemical was administered; environmental details such as temperature, humidity, how the animals were housed and handled, and a multitude of other factors. While these factors will affect the result, so that the LD_{50} will vary somewhat from lab to lab and even from different determinations at the same lab, LD_{50} is a relatively reliable, reproducible indicator of acute toxicity.

III-1-b Portrayal of Dose-Response Information



The plot presents dose-response data for a compound administered orally to mice. The response measured is death, and the LD_{50} is 58 mg/kg. A smooth curve is obtained by plotting the data as a frequency distribution. The dose corresponding to 50% mortality is the LD_{50}.

Appendix VI

VI-1 Major Federal Toxic Substances Laws

1. Atomic Energy Act of 1954
2. Clean Air Act
3. Clean Water Act of 1977
4. Consumer Product Safety Act of 1972
5. Federal Environmental Pesticide Control Act of 1972
6. Federal Hazardous Substances Act
7. Food, Drug and Cosmetic Act
8. Marine Protection, Research, and Sanctuaries Act of 1972
9. Occupational Safety and Health Act of 1970
10. Poison Prevention Act of 1970
11. Ports and Waterways Safety Act of 1972
12. Resource Conservation and Recovery Act of 1976
13. Safe Drinking Water Act
14. Toxic Substances Control Act

15-18. Transportation of Toxic and Hazardous Substances (4 statutes)

1. Atomic Energy Act of 1954, as amended, Act of August 30, 1954, 68 Stat. 921, 42 U.S.C. § 2011, *et seq.*

Synopsis:

A Nuclear Regulatory Commission license must be obtained for the processing, utilization, or distribution in interstate commerce of nuclear materials. The Food and Drug Administration's Bureau of Radiological Health regulates the uses of nuclear materials in the medical arts, and also regulates radioactivity levels in milk. The Environmental Protection Agency has responsibility for advising on environmental standards for radioactive materials, and for setting such standards for drinking water (under the Safe Drinking Water Act) and for ambient air and air emission sources (under the Clean Air Act).

2. Clean Air Act, Act of July 14, 1955, as amended, 69 Stat. 322, 91 Stat. 685, 91 Stat. 1399, 42 U.S.C. § 7401, *et seq.*

Synopsis:

The Clean Air Act requires regulation of hazardous air pollutants from new or existing stationary or mobile sources. New source performance standards may also be imposed on hazardous air pollutants. The Act requires EPA to set general primary and secondary ambient air quality standards for which the states are required to submit implementation plans.

The Act embodies the Congressional finding that air pollution has resulted in mounting dangers to the public health and welfare, and includes the purpose of promoting the public health and welfare and the productive capacity of the Nation's population. (§ 7401).

States have the primary responsibility for assuring air quality within the entire geographic area comprising each State by submitting State-wide implementation plans which specify the manner in which national primary and secondary ambient air quality standards will be achieved and maintained within each air quality control region in a State. (§ 7407(a)).

Each State was required to submit to EPA (by mid-1978) for publication a list of those air quality control regions in the State which as of mid-1977 did not meet national primary and secondary ambient air quality standards, exceeded such standards, or could not be classified in terms of their ability to meet sulfur oxide and particulate levels. (§ 7407(d)).

The Administrator is required to publish and periodically update a list of air pollutants which "may reasonably be anticipated to endanger public health or welfare." He must then issue "air quality criteria" for each of these pollutants which accurately reflect the latest scientific knowledge regarding the kind and extent of all identifiable effects of the pollutants on public health or welfare. At the same time, the Administrator is required to issue information on air pollution control techniques, including available data on "available technology" and alternative methods of prevention and control of air pollution. The issuance of air quality criteria and information on control techniques is required to be announced in the Federal Register with copies to be made available to the general public. (§§ 7408(a)-(d)).

EPA is required to publish regulations prescribing national primary and secondary ambient air quality standards for each air pollutant for which air quality criteria have been issued. The primary standards must be such as are requisite to protect the public health (allowing an adequate margin of safety). Secondary standards must be such as to protect the public welfare from any known or anticipated adverse effects associated with the air pollutants in question. (§§§ 7409(a),(b)).

The States are required to adopt and submit for EPA approval implementation plans for meeting and enforcing national primary and secondary ambient air quality standards. (§ 7410(a)).

The Administrator is required to publish a list of categories of stationary sources which contribute significantly to air pollution and may reasonably be anticipated to endanger public health or welfare. Federal standards of performance for new sources within each such category must then be promulgated. Implementation and enforcement of these standards of performance must be delegated to qualified States, although EPA retains concurrent enforcement authority. The Administrator is required to promulgate regulations providing for States to submit implementation plans for applying standards of performance to air pollutants produced by existing sources within the categories covered by the new source standards, for which air quality criteria have not been issued. (§ 7411).

The Administrator is required to publish a list of hazardous air pollutants, for which he must then establish emission standards. A "hazardous air pollutant" is one for which there is no applicable ambient air quality standard and which in the Administrator's judgment contributes to air pollution which "may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." Once an emission standard becomes effective for a hazardous air pollutant, no new source may be constructed or existing source modified which will cause the standard to be exceeded. Nor may any air pollutant be emitted from any stationary source in violation of the standard. Implementation and enforcement are to be delegated to qualified States, with concurrent enforcement authority retained by EPA. (§§7412(a)-(d)).

Any records, reports or information obtained from emission sources by the Administrator must be available to the public, except upon a showing that public release would divulge trade secrets or confidential information. (§7414(c)).

The Administrator is required to review all available relevant information and determine whether or not emissions of radioactive pollutants, cadmium, arsenic and polyclic organic matter will contribute to air pollution which may reasonably be anticipated to endanger public health. Substances for which the Administrator makes an affirmative determination must then be included on the hazardous air pollutant list and/or on the list of categories of new sources. (§7422).

State implementation plans must contain effective measures for notifying the public on a regular basis of instances or areas in which any national primary ambient air quality standard was exceeded, including advising the public of the health hazards associated with such pollution. (§7427).

Upon receipt of evidence that a pollution source is presenting an imminent and substantial endangerment to the health of persons, and that a State and local officials have not acted to abate it, the Administrator is authorized to bring a civil suit to immediately restrain the emission, or to issue necessary emergency orders to assure prompt protection of human health. (§7603).

Citizen suits are authorized against violators of emission standards and limits, against the Administrator for failure to perform any non-discretionary act or duty, and against the proposed construction of any new or modified major emitting facility without a required permit or in violation of applicable permit conditions. (§7604).

Federal agencies are prohibited from entering into contracts with anyone convicted of violating implementation plan requirements, etc. (§7606).

3. Clean Water Act of 1977, Act of October 18, 1972, as amended, 86 Stat. 816, 91 Stat. 1566 , 33 U.S.C. §1251, *et seq.*

Synopsis:

The Clean Water Act of 1977 ("CWA") is a lengthy and complex statute. The "Committee Print" of the statute takes up 125 pages. It is, however, an extremely important statute from the standpoint of toxic substances control.

Section 101(a) of the CWA states the Act's objective as being "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Among the goals and policies announced to promote this objective are: a national goal of eliminating "the discharge of pollutants into the navigable waters" by 1985 (§101(a)(1)); a national goal of attaining an interim goal of fishable and swimmable waters by July 1, 1983 (§101(a)(2)); a national policy of prohibiting "the discharge of toxic pollutants in toxic amounts" (§101(a)(3)); and a national policy of making a major research and demonstration effort "to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans" (§101(a)(6)).

The CWA also emphasizes, in very strong language, the importance of promoting public participation in CWA programs. Section 101(e) directs the EPA Administrator and the States to provide for, encourage, and assist public participation "in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program" established under the Act.

Section 301(a) prohibits the discharge of any pollutant without a permit under Section 402, and except in compliance with technology-based effluent limitations under Section 301, water-quality-related effluent limitations under Section 302, new source performance standards under Section 306, and toxic and pretreatment effluent standards under Section 307.

Section 301(b)(1)(A) requires all discrete ("point source") dischargers (other than publicly owned treatment works—"POTW's") to apply "best practicable control technology currently available" ("BPT"), as defined under Section 304(b). This requirement is limited, however, to facilities discharging directly into a waterway. "Indirect dischargers"—those that discharge via a POTW rather than directly into a waterway must satisfy applicable pretreatment and toxic control requirements under Section 307. Dischargers must also meet any more stringent requirements under applicable water quality standards or under any other applicable State or Federal law or regulation (§301(b)(1)(C)).

Section 301(b)(2)(A) requires direct discharging point sources to apply "best available technology economically achievable" ("BAT") within their industry category or class, which "will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants," and which will eliminate discharges of all pollutants if such elimination is technologically and economically achievable. Indirect dischargers must comply with any applicable pretreatment and toxic requirements under Section 307. Compliance must be achieved by July 1, 1984, for 65 specified toxic pollutants (the so-called "Consent Decree" pollutants.)(§301(b)(2)(C)); within 3 years from the establishment of effluent limitations for other toxic pollutants under §307(a)(1))(§301(b)(2)(D)); and by July 1, 1987, at the latest, for all other pollutants (§301(b)(2)(F)).

Section 303 provides for the establishment of water quality standards for interstate and intrastate waters. Revised or new standards must protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

Section 304(b) requires the Administrator to publish effluent limitation guidelines defining BPT and BAT for classes and categories of point sources. Section 304(e) gives the Administrator the discretion to publish regulations establishing effluent controls supplementary to BPT and BAT requirements for "any specific pollutant which the Administrator is charged with a duty to regulate as a toxic or hazardous pollutant under section 307(a)(1) or 311," in order to control sludge or waste disposal, etc., which the Administrator determines "may contribute significant amounts of such pollutants to navigable waters." Section 304(g)(1) requires the Administrator to publish guidelines for the pretreatment of pollutants which are not susceptible to treatment by POTW's. And Section 304(h) requires the Administrator to promulgate guidelines establishing test procedures for the analysis of pollutants.

Section 306 requires the Administrator to establish new source performance standards, prescribing BAT-level controls, for categories of point sources.

Section 307(a)(1) establishes a toxic substances list, initially containing 65 groups of specific chemicals, which the Administrator is authorized to revise periodically, taking into account various factors, including the toxicity of the pollutant, its persistence, degradability, and its impacts on affected organisms in any waters. Section 307(b)(2) requires the Administrator to establish "effluent limitations" based upon BAT for each listed toxic pollutant for the applicable category or class of point sources. In addition, the Administrator may publish more stringent toxicity-oriented "effluent standards" or prohibitions. (§ 307(a)(3)).

Effluent standards must provide an "ample margin of safety" and must be applied to specified categories of sources (§§ 307(a)(4),(5)).

Section 307(b)(1) requires the Administrator to establish "pretreatment standards" for pollutants which are discharged into POTW's and which are determined not to be susceptible to treatment or to interfere with the operation of the treatment works. These standards must specify a time for compliance of not more than three years and must be designed to prevent the discharge of incompatible pollutants through the treatment works. (§§ 307(b)(2),(3)).

Section 307(c) requires the Administrator to promulgate pretreatment standards for "new source" indirect dischargers. These pretreatment standards must prevent the discharge of incompatible pollutants into the POTW. Section 307(d) makes it unlawful for a discharge to take place in violation of any applicable effluent standard or prohibition or pretreatment standard.

Section 308 directs the Administrator to require dischargers to establish and maintain records and other information necessary to carry out the Act's objectives. Effluent data must be related to applicable effluent limitations and must be made available to the public, subject to specified "trade secret" exceptions.

Section 309 provides for Federal enforcement of the conditions and limitations implementing §§ 301, 302, 306, 307, 308, 318, 402, 404, and 405 of the Act. The Administrator may issue compliance orders giving dischargers a specified amount of time to correct violations. He may commence civil actions, either to enforce compliance orders, or to enjoin violations and secure other appropriate relief. And he may initiate criminal action against any person who "willfully or negligently" violates §§ 301, 302, 306, 307, 308, 402, or 405 of the Act.

Section 311(b)(2)(A) requires the Administrator to develop and publish regulations designating as "hazardous substances," those elements and compounds (other than oil) which, when discharged in any quantity into U.S. waters or on adjoining shorelines, "present an imminent and substantial danger to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, and beaches." (§ 311(b)(2)(B)(i)). The Administrator is empowered to act to mitigate the damage caused to public health and welfare, by the discharge, with the cost of such mitigation being added to the removal costs assessed against the dischargers (§ 311(b)(2)(B)(iv)). Section 311(b)(3) prohibits the discharge of oil or hazardous substances into U.S. waters or on shorelines "in harmful quantities." "[T]hose quantities of oil and any hazardous substance the discharge of which, at such times, locations, circumstances, and conditions, will be harmful to the public health or welfare of the United States" is to be established by regulation by the President, under § 311(b)(4). Section 311(c)(1) authorizes the President to act to remove oil or a hazardous substance at any time whenever these materials are discharged, or there is a "substantial threat" of such discharge, into or upon U.S. waters or shorelines.

Section 313 requires Federal facilities to comply with all Federal, State, interstate, and local requirements concerning the control and abatement of water pollution "in the same manner, and to the same extent" as any nongovernmental entity. The President is, however, authorized to provide one-year exemptions for Executive Branch effluent sources where he determines it to be "in the paramount interest of the United States," except that the requirements of §§ 306 and 307 are non-waivable.

Section 402 is, in many respects, the cornerstone of the Clean Water Act. It establishes a permit system for regulating all pollutant discharges (with a few exceptions) into navigable waters. This permit system is known as the "National Pollutant Discharge Elimination System," with permits commonly referred to as "NPDES" permits. Section 402(a)(1) authorizes the Administrator to issue an NPDES permit for the discharge of any pollutant (after "opportunity for public hearing"), upon condition that the discharge will meet all applicable requirements under §§ 301, 302, 306, 307, 308, and 403 of the Act. Section 402(a)(2) requires the Administrator to prescribe permit conditions necessary to comply with the requirements of paragraph (a)(1), "including conditions on data and information collection, reporting," and other appropriate requirements. Section 402(a)(3) requires EPA's permit program to apply the same terms, conditions, and requirement as apply to a State permit program.

Section 402(a)(5) requires the Administrator to delegate permit-issuing responsibility for navigable waters within their jurisdiction to States which he determines have the capability of administering a permit program which will carry out the Act's objectives. The Administrator retains the right, however, to impose necessary conditions on such permits, and no NPDES permit may be issued by a State if the Administrator objects to its issuance. Section 402(b) sets forth the necessary components of an approvable State program (which must also be applied by EPA's permit program). Among these components is adequate authority to insure that any permit for a discharge from a POTW includes conditions to require identification of the character and volume of pollutants from any significant industrial source which is subject to § 307(b), and a program to assure compliance with pretreatment standards by each source. The permit must also require adequate notice to the permitting agency of information on the quality and quantity of effluent to be introduced into the POTW. State-issued permits, moreover, must insure that any industrial user of a POTW will comply with § 307 and certain other provisions.

Section 402(c)(2) requires any State NPDES program to be at all times in compliance with § 402, and the Administrator is required to withdraw approval from a State program, under § 402(c)(3), whenever he determines that the program is not being administered in accordance with § 402 requirements, if appropriate corrective action is not taken.

Section 402(j) expressly requires copies of "each permit application and each permit issued under this section" to be made available to the public.

Section 402(k) makes compliance with an NPDES permit automatic compliance with §§ 301, 302, 306, 307, and 403, but not necessarily with standards imposed under § 307 for a toxic pollutant injurious to human health.

Section 504 authorizes the Administrator to bring suit to immediately restrain the discharge of pollutants from any source or combination of sources upon receipt of evidence that the discharge is presenting "an imminent and substantial endangerment to the health of persons" or to the livelihood of persons. The Administrator is also authorized to provide emergency assistance, including application of measures to abate and remedy the emergency and the performance of research on the effects of an emergency on health and the environment.

Section 505 is a "Citizen Suit" provision. It authorizes any citizen, in addition to otherwise available remedies, to bring a citizen, in civil suit against any violator of an effluent standard or limitation or of a duly issued compliance order. The citizen may also sue the Administrator for failing to perform any nondiscretionary act or duty. Before a citizen suit may be brought under this provision, however, the plaintiff must give sixty days' advance notice of the alleged violation to the Administrator, to the State in which the violation occurred, and to any alleged violator. This notice is intended to provide the alleged violator with a last opportunity to voluntarily correct the violation. It may also give EPA or a State the opportunity to initiate enforcement action on their own (in which case, the citizen may still intervene in the case as a matter of right). Courts are empowered, in ruling on a citizen suit, to award costs of litigation to any party, whenever appropriate.

Finally, among various miscellaneous provisions in the Act, § 508(a) bars Federal agencies from entering into contracts with persons who have been convicted of offenses under § 309—at least if the contract is to be performed at the facility at which the violation occurred, and if the facility is owned, leased, or supervised by the person convicted. The threat of lost government contracts can sometimes be a more powerful prod to compliance with pollution laws than the fear of incurring a modest civil or criminal penalty.

4. Consumer Product Safety Act of 1972, Act of October 27, 1972, 86 Stat. 1207, as amended by the CONSUMER PRODUCT SAFETY COMMISSION IMPROVEMENTS ACT OF 1976, Act of May 11, 1976, 90 Stat. 503, as amended by the EMERGENCY INTERIM CONSUMER PRODUCT SAFETY STANDARD ACT OF 1978, Act of July 11, 1978, 92 Stat. 386, 15 U.S.C. § 2051, *et seq.*

Synopsis:

The Act authorizes the Consumer Product Safety Commission to set standards regulating the performance, composition, content, design, construction, packaging, or labeling of consumer products. Where no feasible safety standard can adequately protect the public, the Commission may totally ban the product. The Act encompasses any article or component, produced or distributed for sale to consumers for use in or around a household or residence, school, or for recreational purposes. The term "consumer product" excludes tobacco products, motor vehicles, pesticides, boats, aircraft, and food, drug, and cosmetic items. It does, however, include such things as aluminum branch circuit wiring in a home and amusement park rides (as long as the associated risks do not threaten only employees). Any interested consumer may petition the Commission to issue, amend, or revoke a consumer product safety rule.

5. Federal Environmental Pesticide Control Act of 1972, Act of June 25, 1947, as amended, 86 Stat. 975, 87 Stat. 903, 89 Stat. 754, 7 U.S.C. § 321, *et seq.*

Synopsis:

Requires all formulators and producers of pesticides to have their products and establishments registered with EPA on the basis of submitted safety data. Prohibits the sale, distribution and use of pesticides except in accordance with registered labels.

Covered "pesticides" include (1) substances (other than antibiotics) intended for destroying or repelling any "pest" (defined to include organisms ranging from viruses and bacteria to rodents), and (2) substances intended for use as a plant regulator or destroyer. Excludes "new animal drugs" and "animal feeds." (§ 136(u)).

Prohibits, subject to specified exceptions, the distribution, sale, advertisement, shipment, and delivery of any pesticide which is not registered with the EPA Administrator. (§ 136a(a)).

Applications for registration of a pesticide must include a statement which includes the name of the pesticide, its complete chemical formula, and a complete copy of the labeling of the pesticide. (§ 136a(c)(1)).

The Administrator is required to publish, and periodically revise, guidelines specifying the kinds of information which will be required to support the registration of the pesticide. Subject to trade secret exclusions, the Administrator must make available to the public within 30 days after registering a pesticide the data called for in the registration statement, together with other relevant scientific information. (§ 136a(c)(2)).

The Administrator is required to promptly publish a notice in the Federal Register of each application for registration of a pesticide if it contains any new active ingredient or would entail a changed use pattern. Interested persons must be allowed 30 days in which to comment. (§ 135a(c)(4)).

Registration of a pesticide must be approved if the Administrator determines that the claims proposed for a pesticide are warranted by its composition, that labeling and application requirements have been met, that the pesticide will perform its intended function without "unreasonable adverse effects on the environment," and that the pesticide, when used in accordance with widespread and commonly recognized practice, will not generally cause "unreasonable adverse effects on the environment." (§ 136a(c)(5)). If these requirements are not met, the Administrator must inform the applicant; he may refuse to register the pesticide if the applicant does not correct the conditions within 30 days. (§ 136a(c)(6)).

In registering a pesticide, the Administrator must classify it for either general use (if it will not cause unreasonable adverse effects on the environment) or for restricted use (if it may cause such effects without additional regulatory restrictions). (§ 136a(d)).

The Administrator may grant an "experimental use permit" for a pesticide if he determines that the applicant needs a permit of this kind in order to accumulate information necessary to register a pesticide. He may establish a "temporary tolerance level" for the pesticide if he determines that it may reasonably be expected to result in any residue on or in food or feed. (§ 136c(a),(b)).

The Administrator is required to cancel the registration of any pesticide at the end of five years unless the registrant seeks continuation of the registration before the end of this period. (§ 136d(a)(1)).

After a pesticide has been registered, if the registrant has "additional factual information" regarding "unreasonable adverse effects" of the pesticide on the environment, he must submit this information to the Administrator. (§ 136d(a)(2)).

The Administrator may issue a notice of his intent either (1) to cancel a pesticide's registration or to change its classification, or (2) to hold a hearing to determine whether or not its registration should be canceled or its classification changed, if it appears to him that a pesticide or its labeling or required submissions do not comply with the Act's requirements. If the Administrator determines that suspension of a pesticide registration is necessary to prevent an "imminent hazard to human health," the proposed action becomes final and effective at the end of 30 days from publication or receipt of the notice announcing this action. Otherwise, the Secretary of Agriculture must first be given 30 days in which to respond to the proposal. (§ 136d(b)).

Details of the procedure for suspending the registration of a pesticide to prevent an imminent hazard are set forth in § 136d(c).

Establishments which produce any covered pesticide must register with EPA. The registration statement must contain information on the types and amounts of pesticides currently produced (and produced, sold and distributed during the past year). This information is to be considered confidential and subject to trade secret requirements. (§ 136e).

Section 136h provides for protection of trade secrets and privileged or confidential information.

It is unlawful to detach, alter or destroy any required labeling of a pesticide; to use any registered pesticide in a manner inconsistent with its labeling; and to add any substance to, or take any substance from, any pesticide in a manner that may defeat the Act's purposes. (§ 136j(a)).

The Administrator is required, after consultation with other interested Federal agencies, to establish procedures and regulations for the disposal or storage of packages and containers of pesticides and accept at convenient locations for safe disposal a pesticide the registration of which is canceled if requested by the owner of the pesticide. (§ 136q).

Enforcement and judicial review procedures, and applicable civil and criminal penalties, are set forth in Sections 136g(c), 136n, and 136*l*.

6. Federal Hazardous Substances Act, Act of July 12, 1960, 74 Stat. 372, as repeatedly amended (most recently in 1976), 15 U.S.C. § 1261, *et seq.*

Synopsis:

The Act prohibits the introduction into interstate commerce of any "misbranded hazardous substance" or "banned hazardous substance." It also prohibits the introduction into interstate commerce of a "hazardous substance" in a reused food, drug, or cosmetic container, or in a container labelled or identified as a food, drug, or cosmetic container. Hazardous substances are toxic, corrosive, and other dangerous articles intended for or accessible to use by children, including articles suitable for household use. They are considered "misbranded" if such articles fail to bear prominent warning labels. They are "banned" if the Commissioner of the Consumer Product Safety Commission determines they are so inherently dangerous that the health and safety of the public can be adequately assured only by keeping them off the market.

7. Food, Drug and Cosmetic Act, Act of June 25, 1938, 52 Stat. 1040, as repeatedly amended, 21 U.S.C. § 301.

Synopsis:

The Act prohibits the introduction in commerce of "adulterated" or misbranded foods, drugs, devices, or cosmetics (§ 331).

A food is considered adulterated if it contains any harmful ("poisonous or deleterious") substance (whether added or not) which may make it injurious to health, or which is "unsafe" (§ 342(a)(1)).

Any harmful substance added to any food, except where required in food production or unavoidable by good manufacturing process, is deemed unsafe (§ 346).

Any harmful pesticide chemical, or any pesticide chemical which is not "generally recognized . . . as safe" for use (i.e., on a "GRAS" list), and which is added to a raw agricultural commodity, is deemed unsafe unless the pesticide level in the commodity is within tolerance limits prescribed by the EPA Administrator (§ 34).

A food additive is considered unsafe unless (1) it is being used in accordance with the terms of an applicable exemption, or (2) it is being used in accordance with a regulation prescribing the conditions under which it may be safely used (§ 348(a)).

"Food additive" is defined as any substance the intended use of which may result in its becoming a component of or otherwise affecting the characteristics of any food, unless the substance is generally recognized as safe (§ 321(s)).

The HEW Secretary may establish regulations prescribing the conditions under which a food additive may be safely used. He may do so, either on his own initiative, or in response to a petition by any person. No regulation may issue, however, if a fair evaluation of the data fails to establish that the proposed use of the food additive will be safe. No additive may be deemed safe if it is found to induce cancer when ingested by man or animal [Delaney Clause] (§ 348(b), (c)).

8. Marine Protection, Research, and Sanctuaries Act of 1972, Act of October 23, 1972, as amended, 86 Stat. 1052, 88 Stat. 50, 91 Stat. 1255, 33 U.S.C. § 1401, *et seq.*

Synopsis:

This Act, popularly known as the "Ocean Dumping Law", consists of three parts or "titles". Only Title I will be summarized here, since Title II describes the research program of the National Oceanic & Atmospheric Administration and Title III concerns the establishment of "marine sanctuaries."

The Ocean Dumping Law is structured around a permit program which regulates all materials transported out of a U.S. port or on a U.S. vessel for the purpose of disposal at sea. In recent years, the Act's application has been extended to the at-sea incineration of industrial wastes aboard specially designed incinerator ships. The Act covers all ocean dumping under U.S. jurisdiction as defined above, no matter how far out to sea.

The Act allows the EPA Administrator to issue an ocean dumping permit for the disposal of industrial and municipal wastes, or approve the use of an ocean location as a disposal site, only in accordance with ocean dumping criteria established by EPA. The criteria are required to reflect nine specified evaluation factors, including the need for and availability of alternatives to the proposed dumping, the feasibility of utilizing dumpsites off the edge of the Continental Shelf, and a variety of factors relating to the effects of the dumping on human health and welfare and on marine ecosystems.

Ultimately, an ocean dumping permit may be issued only where the Administrator determines that the proposed dumping "will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." (§ 102-(a)). All permit actions must be preceded by public notice and an opportunity for public hearing. The Act expressly requires all information received by EPA as part of any ocean dumping permit application or in connection with any permit granted under the ocean dumping law to "be available to the public as a matter of public record, at every stage of the proceeding." (§ 104(f)).

As is true for most of the other Federal environmental statutes, the ocean dumping law contains a "Citizen Suit" provision, requiring the usual 60-days' advance notice, and allowing the reviewing court to award either party "costs of litigation," including reasonable attorney and expert witness fees. (§ 105(g)).

9. Occupational Safety and Health Act of 1970, Act of Dec. 29, 1970, 84 Stat. 1590, 29 U.S.C. § 651, *et seq.*

Synopsis:

The Act requires employers to furnish workers employment conditions free from recognized hazards that are likely to cause death or serious physical harm (§ 654(a)(1)).

Employers must comply with the safety and health standards established under this Act (§ 654(a)(2)).

The Secretary of Labor is authorized to establish occupational safety and health standards, after notice of proposed rulemaking and an opportunity for *public comment* (§ 655(a), (b)).

Standards dealing with "toxic materials" or "harmful physical agents" should be those which most adequately assure that no employee will suffer material impairment of health or functional capacity even if the employee is regularly exposed to the hazard throughout his working life. Whenever practicable, the standard must be expressed in terms of "objective criteria" and of "the performance desired." (§ 655(b)(5)).

Standards must prescribe use of appropriate warning labels and devices and, where appropriate, suitable protective equipment, control procedures, monitoring of employee exposure, and periodic medical examinations of employees (§ 655(b)(7)).

Emergency temporary standards, effective immediately for up to 6 months, must be established where the Secretary determines they are necessary because employees are exposed to "grave danger" from exposure to "toxic" or physically harmful substances or agents or to "new hazards." (§ 655(c)).

Affected employees must be given an opportunity to participate in hearings on employer requests for variances from established health and safety standards (§ 655(d)).

Employers must keep records as prescribed by the Secretary of Labor in cooperation with the Secretary of HEW, as necessary or appropriate for developing information regarding the causes and prevention of occupational accidents and illnesses (§ 657(c)(1)).

The Secretary must require employers to maintain accurate records of employee exposures to potentially toxic materials or harmful physical agents which must be monitored or measured under § 655 of the Act. Employees must have access to these records and they must be promptly notified of any exposure to these agents in excess of applicable standards (§ 657(c)(3)).

Any employees or employee representatives may, by written notice to the Secretary of Labor, request a special inspection of a workplace where they believe a violation of a safety or health standard exists that threatens physical harm, or that an imminent danger exists. If the Secretary determines that there are reasonable grounds to believe that such a violation or danger exists, he must make a special inspection as soon as possible (§ 657(f)(1)).

The Act prohibits reprisals against employees for exercising rights under the Act (§ 660(c)).

The Act provides for issuance of "citations" and "notices in lieu of citations" against violators (§ 658), for enforcement of citations before an Occupational Health and Safety Review Commission (§ 659), for judicial review and enforcement of Commission orders (§ 660), for injunctive relief (§ 662), and for imposition of civil and criminal penalties (§ 666).

10. Poison Prevention Act of 1970, Act of Dec. 30, 1970, as amended, 86 Stat. 998, 15 U.S.C. § 1471.

Synopsis:

The Act requires special packaging of certain "household substances" which may pose a hazard to children.

"Household substances" covered include:

(1) "hazardous substances" (as defined in the Federal Hazardous Substances Act, 15 U.S.C. § 1261(f)), such as toxic, corrosive, and flammable substances and mixtures which may cause substantial personal injury as a result of reasonably foreseeable handling or use, and any article intended for use by children which presents an electrical, mechanical, or thermal hazard;

(2) "pesticides" (as defined in the Federal Environmental Pesticide Control Act of 1972, 7 U.S.C. § 136(u));

(3) "foods," "drugs," and "cosmetics" (as defined in the Federal Food, Drug and Cosmetic Act, 21 U.S.C. § 321); and

(4) containerized fuels used in home heating, cooking, or refrigeration systems (§ 1471(2)).

The Secretary of HEW is authorized to set standards for the special packaging of a household substance if he finds it necessary in order to protect children from serious personal injury or illness, and finds the standards to be feasible, practicable, and appropriate for the substance. (§ 1472(a)).

Special packaging standards are to be established after notice of proposed rulemaking and opportunity for public comment (§ 1474(a)).

Whenever a packaging standard has been established under this Act, no state or locality may impose differing standards. (§ 1476).

11. Ports and Waterways Safety Act of 1972, Act of July 10, 1972, 86 Stat. 424, 33 U.S.C. § 1221, *et seq.*

Synopsis:

Title II of the Act requires the Secretary of Transportation (through the U.S. Coast Guard) to establish rules and regulations aimed at preventing or mitigating damage to the marine environment associated with vessels carrying liquid cargo that is flammable or combustible, oil, or a hazardous polluting substance. These regulations specify minimum standards of design, construction, alteration, repair, maintenance, and operation for such vessels.

12. Resource Conservation and Recovery Act of 1976, Act of October 21, 1976, 90 Stat. 2795, 42 U.S.C. § 6901, *et seq.*

RCRA was built on the foundation of the Solid Waste Disposal Act of 1965 and the Resource Recovery Act of 1970 in the face of a growing solid waste disposal problem. Among other provisions, the legislation establishes a permit program to manage potentially hazardous materials from their point of origin to their point of ultimate disposal; from "cradle to grave," as it were.

The Act is subdivided into nine subtitles, including Subtitle C dealing with "Hazardous Waste Management." The major provisions applicable to toxic substances control can be summarized as follows:

Subtitle A sets forth the congressional findings that the disposal of "hazardous waste" on the land can present a danger to human health and the environment if done without careful planning and management, and that hazardous waste presents special dangers to health and requires a greater degree of regulation than does non-hazardous solid waste (§ 1002(b)). "Solid waste" is defined broadly to include any discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities—subject to several specified exceptions (§ 1004(27)). "Hazardous waste" is a category of solid waste which, because of quantity, concentration, or physical, chemical, or infectious characteristics may contribute to an increase in mortality or serious illness, or may pose a substantial hazard to human health or the environment when improperly managed (§ 1004(5)). Subtitle A directs the EPA Administrator to publish guidelines on solid waste management to be used by the States for determining compliance with Subtitle C controls on hazardous waste management (§ 1008(a)). The subtitle also encourages the integration of RCRA with other statutes, and prohibits the inconsistent application of RCRA to activities or substances subject to other Acts (§ 1006).

Subtitle B establishes an Office of Solid Waste within EPA (headed by a Deputy Assistant Administrator) to oversee the implementation of the Act's hazardous waste and other provisions (§ 2001). This office is the focal point for consultations with representatives of the public (§ 2002(a)(4)).

EPA is required to use at least 30% of the funds appropriated under the Act solely for carrying out §§ 3002 through 3011 of subtitle C, relating to hazardous wastes (§ 2006(c)).

One of the primary thrusts of RCRA is to impose new requirements on the management of hazardous wastes. These are contained in Subtitle C.

The Administrator is required to promulgate *criteria* for identifying the characteristics of hazardous waste, and for listing hazardous waste which should be subject to subtitle C. In doing so, he must take account of such factors as toxicity, potential for accumulation in tissue and other hazardous characteristics. He must also promulgate *regulations* identifying the characteristics of hazardous waste, and listing particular hazardous wastes subject to subtitle C, based on the previously established criteria. The Governor of any State may also petition to have any material identified or listed as a hazardous waste, and the Administrator must respond with 90 days (§ 3001).

The Administrator is required to promulgate standards applicable to hazardous waste *generators* which establish requirements regarding recordkeeping practices, labeling practices, use of appropriate containers, furnishing of information on the general chemical composition of a hazardous waste to those who transport, treat, store or dispose of it, use of a manifest system, and submission of reports to the Administrator or an authorized State agency. (§ 3002).

The Administrator is required to promulgate standards applicable to hazardous waste *transporters*, which must include at minimum recordkeeping, labeling, and manifest use requirements, and which require hazardous waste to be transported only to treatment, storage, or disposal facilities which the shipper designates on the manifest to be holders of a Subtitle C permit. For any hazardous waste which is subject to the Hazardous Materials Transportation Act, 49 U.S.C. § 1801, *et seq.*, the standards must be consistent with that Act and its implementing regulations (§ 3003).

The Administrator is also required to promulgate regulations establishing performance standards applicable to *owners and operators* of hazardous waste treatment, storage and disposal facilities. Such standards must require recordkeeping; reporting, monitoring, inspection, and compliance with the manifest system; transportation, storage, and disposal in accordance with satisfactory operating methods, techniques, and practices; compliance with criteria for the location, design, and construction of treatment, storage and disposal facilities; contingency plans to minimize unanticipated damage; owner and operator performance standards; and compliance with § 3005 permit requirements (§ 3004).

In addition, the Administrator is required to promulgate regulations requiring *owners and operators* of treatment, storage and disposal facilities, to have a subtitle C permit. These regulations become effective 6 months after promulgation; thereafter, hazardous waste disposal is prohibited except in accordance with such a permit (§ 3005(a)). Permit applications must include estimates of the material's composition, quantities, and concentration; and the site at which it will be processed, disposed of or stored (§ 3005(b)). A permit *must* be issued, if the Administrator (or an authorized State) determines that §§ 3004 and 3005 have been complied with. If modifications are necessary, the permit must specify the time allowed to complete the modifications (§ 3005(c)). The permit *must* be revoked upon a determination of noncompliance with § 3004 or § 3005(d)). A permit applicant will be treated as though he had a permit, if the facility to be permitted was "in existence" as of October 21, 1976, and § 3010(a) (relating to preliminary notification) has been complied with—unless the delay in obtaining a permit is due to the applicant's failure to furnish reasonably required information (§ 3005(e)).

The Administrator is also required to promulgate guidelines to assist States in the development of *State hazardous waste programs.* States are authorized to carry out their own programs unless the Administrator, within 90 days after receipt of an application, issues a notice that the program may not be authorized and within an additional 90 days, makes a finding that the State program is not equivalent to the federal program, or is not consistent with federal or State programs applicable in other States, *or* does not provide adequate enforcement of compliance with subtitle C requirements. A two-year interim authorization may be granted for State programs found to be substantially equivalent to the federal program. Once a State program is authorized, State action under the program has the same legal force and effect as action taken by the Administrator. Authorization must be withdrawn and the federal program reestablished whenever a State is not administering and enforcing its program in accordance with § 3006, and where appropriate corrective action is not taken within 90 days of notification (§ 3006).

Any records, reports, or information relating to a hazardous waste, obtained from any person under § 3007(a), must be available to the public, subject to the protective provisions of 18 U.S.C. § 1905 (§ 3007(b)).

The Administrator may enforce the requirements of subtitle C in a variety of ways including: compliance orders, permit suspension and revocation orders, and criminal and civil enforcement actions (§§ 3008).

Once the Subtitle C regulations become effective, no State or political subdivision may continue to impose any inconsistent requirements which are less stringent than those authorized by subtitle C (§ 3009).

The § 3001 regulations take effect 6 months after promulgation (or revision). However, within 90 days after promulgation or revision of such regulations, all hazardous waste generators, transporters, or owners or operators of a treatment, storage, or disposal facility must file with the Administrator (or an authorized state), a notification stating the location and general description of the activity and the identified or listed hazardous wastes handled. No identified or listed hazardous waste may be transported, treated, stored, or disposed of unless such notification has been given (§ 3010).

Finally, the Administrator is authorized to make grants to States to assist in developing and implementing authorized hazardous waste programs. Such grants are to be made on the basis of regulations which take into account the extent of the hazardous waste problem in each State (§ 3011).

Subtitle F subjects federal facilities to the requirements of RCRA to the same extent as private facilities.

Subtitle G provides protection for "whistle-blowers"—employees who testify in or institute any proceeding under RCRA (§ 7001); authorizes citizen suits against the Administrator or any other person (§ 7002); empowers the Administrator to file suit to immediately restrain any solid waste handling activity which presents an imminent and substantial endangerment to health or the environment (§ 7003); authorizes any person to petition the Administrator for the promulgation, amendment, or repeal of any regulation under RCRA, with the Administrator required to respond within a "reasonable time" (§ 7004(a)); requires the Administrator and authorized States to provide for, encourage, and assist public participation in the development, etc. of any regulation, guideline, information or program under the Act, and requires the Administrator to develop minimum guidelines for public participation (§ 7004(b)); requires judicial challenges to rulemaking by the Administrator to be filed in the U.S. Court of Appeals for the District of Columbia within 90 days of promulgation (§ 7006); and sets forth miscellaneous other provisions.

As usual, public participation is permitted and encouraged in rulemaking proceedings under RCRA.

13. Safe Drinking Water Act, Act of Dec. 3, 1974, as amended, 88 Stat. 1660, 91 Stat. 139, 42 U.S.C. § 300f, et seq.

Synopsis:

The Safe Drinking Water Act ("SDWA") was designed to regulate contaminant levels in public water systems used for drinking water and to protect underground sources of drinking water from contamination due to waste disposal activities.

Parts A and B of the Act require the EPA Administrator to establish primary and secondary drinking water regulations. The primary regulations must specify criteria and procedures for maintaining drinking water contaminants at levels which will avoid "any adverse effect on the health of persons." The secondary regulations must specify the maximum contaminant levels consistent with protecting "the public welfare" (e.g., to avoid undesirable odors and appearance, even if not a public health threat).

For purposes of the primary regulations, maximum contaminant levels must be set at a level at which "no known or anticipated adverse effects on the health of persons occur and which allow[s] an adequate margin of safety" (§§ 1412(b)(1)(B), 1412(b)(3)).

Prior to promulgating both primary and secondary regulations, the Administrator must provide notice (in the Federal Register) and opportunity for public comment (in writing) and public hearing (§ 1412(d)).

Qualifying States may be delegated primary enforcement responsibility under the SDWA for public water systems (§ 1414). States and political subdivisions remain free, however, to adopt and enforce drinking water controls more stringent than those required under the SDWA (§ 1414(e)). Where the Administrator finds that a State which has been delegated primary enforcement responsibility is in noncompliance with SDWA requirements, he may hold public hearings to gather information on ways to bring the system into compliance within the earliest feasible time and on means of affording the maximum feasible protection of the public health in the interim. Such hearings may be convened upon the petition of persons served by noncomplying public water systems, among others (§ 1414(f)).

Under specified, limited circumstances, variances and exemptions from national primary drinking water regulations may be granted on a case-by-case basis (§§ 1415, 1416).

Part C of the SDWA requires the Administrator to publish regulations for State underground injection control programs. These regulations must contain "minimum requirements for effective programs to prevent underground injection which endangers drinking water sources" (§ 1421(b)(1)), but must, to the extent feasible, avoid requirements which would "unnecessarily disrupt State underground injection control programs which are in effect and being enforced in a substantial number of States" (§ 1421(b)(3)(B)). For purposes of these provisions, "underground injection" means "the subsurface emplacement of fluids by well injection"—underground disposal of liquid wastes by discharge into deep wells (§ 1421(d)). Before any regulation under this Part may be established, there must be public notice, opportunity for public comment, and an opportunity for public hearing (§§ 1421(a)(2), 1421(b)(4), 1421(c)(2)).

Part D gives the Administrator the emergency power to take any necessary action to protect public health "upon receipt of information that a contaminant which is present in or is likely to enter a public water system may present an imminent and substantial endangerment to the health of persons . . ." (§ 1431(a)). This applies only where "appropriate State and local authorities have not acted to protect the health of such persons" (§ 1431(a)). Although it may well prove difficult in most cases to demonstrate that a contaminant may imminently and substantially endanger human health, this is the only provision of the Act which allows EPA to take preventive measures to avoid drinking water contamination due to above-ground activities (e.g., landfill disposal of wastes).

Among the SDWA's remaining miscellaneous provisions is one authorizing private citizens to bring civil actions against any person alleged to be in violation of any requirement prescribed by or under the Act, and against the Administrator where he is alleged to have failed to perform any non-discretionary act or duty under the SDWA. As is usual for such citizen suit provisions, sixty days' advance notice of the citizen's intent to sue must be provided before a lawsuit can be initiated. This is designed to enable the prospective defendant to voluntarily mend the error of his ways before the courts become involved (§ 1449).

Challenges to various regulations and orders issued by the Administrator may, however, only be brought within 45 days of their issuance, and in the specified U.S. Court of Appeals (rather than in U.S. District Court, where most federal lawsuits begin) (§§ 1448(a), 1449(e)(2)).

14. Toxic Substances Control Act, Act of Oct. 11, 1976, 90 Stat. 2003, 15 U.S.C. § 2601, *et seq.*

Synopsis:

The Toxic Substances Control Act ("TSCA") authorizes EPA to obtain data from industry on the production, use, and health and environmental effects of chemical substances and mixtures. If necessary, EPA may regulate the manufacture, processing, commercial distribution, use, and disposal of such chemicals and mixtures. Pesticides, tobacco, nuclear material, firearms and ammunition, food, food additives, drugs, and cosmetics are exempted from TSCA because they are currently regulated under other laws.

The Act gives EPA four principal tools for minimizing the toxic hazards of chemicals: (1) testing requirements; (2) premarket notification; (3) direct regulatory authority; and (4) record-keeping and reporting requirements.

EPA may, by regulation, require manufacturers or processors of potentially harmful chemicals to conduct tests (at their own expense) on the chemicals, but the need for such testing must first be established. A need may be shown where the EPA Administrator determines that (a) the chemical may present an unreasonable risk to health or the environment or there may be substantial human or environmental exposure to the chemical; *and* (b) there are insufficient data and experience for determining or predicting the health and environmental effects of the chemical; *and* (c) testing of the chemical is necessary to develop such data. Testing may be required to evaluate the characteristics of a chemical, such as persistence or acute toxicity, or to clarify its health and environmental effects, including its ability to cause cancer, mutations, birth defects, behavioral abnormalities, and to enhance the toxic effects of other chemicals. (§ 4).

Any person who intends to manufacture or process a new chemical, or an existing chemical for a significant new use, must give the Administrator 90 days' notice before manufacturing or processing the chemical. Notices submitted must include the name of the chemical, its chemical identity and molecular structure, proposed categories of use, an estimate of the amount to be manufactured, the byproducts resulting from the manufacture, processing, and disposal of the chemical, and any test data related to the health and environmental effects which the manufacturer has. The manufacturer must also do new tests, and submit the resulting data, if the testing of the chemical or members of its chemical class is required by a rule promulgated by the Administrator, or if the Administrator has included the chemical on a published list of new chemicals or classes of new chemicals which present or may present an unreasonable risk of injury to health or the environment if they are introduced into commerce. Chemicals are exempt from the premarket notification requirement if they are: (a) included in categories listed on the inventory of existing chemicals (which the Administrator is required to publish under § 8); (b) produced in small quantities solely for experimental or research and development purposes; (c) used for test marketing purposes; (d) determined by the Administrator not to prevent an unreasonable risk or determined by the Administrator to be (e) short-lived in the environment and to not give rise to human or environmental exposure.

Following premarket notification, the manufacturer may proceed to produce or process the chemicals involved after 90 days have passed, unless: (a) the Administrator, for "good cause" extends the 90 day review period for another 90 days; (b) the Administrator issues an order at least 45 days before the review period expires to prohibit or limit the manufacture, processing, commercial distribution, use, or disposal of a chemical pending acquisition of additional data (where the Administrator determines that there is inadequate information to evaluate the health and environmental effects of a new chemical); or (c) the Administrator issues an order prohibiting or limiting the manufacture of a chemical (where the Administrator finds that there is a reasonable basis to conclude that a new chemical presents or will present an unreasonable risk of injury to health or the environment). (§ 5).

The Administrator must, prohibit or limit, by regulation, the manufacturing, processing, commercial distribution, use, or disposal of a chemical substance or mixture if he finds that these activities, separately or in combination, present or will present an unreasonable risk of injury to health or the environment. Labelling may be required for a chemical or any article containing it. A manufacturer may be required to keep records of the manufacturing processes used and to conduct tests to assure compliance with any regulatory requirements. Further, a manufacturer may be required to give notice of any unreasonable risk presented by his chemical to those who purchase or may be exposed to it. A manufacturer may also be required to replace or repurchase a substance which presents an unreasonable risk. If a chemical contains a hazardous contaminant as the result of a certain manufacturing process, the Administrator may order the manufacturer to change his process and avoid such contamination. (§ 6).

In addition, TSCA specifically requires the Administrator to regulate polychlorinated biphenyls (PCB's), by issuing labelling and disposal regulations by July 1977, restricting the chemical's use to closed systems by January 1978, prohibiting all production by January 1979, and prohibiting its distribution in commerce by July 1979. (§ 6).

The law requires the Administrator to issue rules requiring manufacturers and processors of selected chemicals to report to EPA the name of each chemical, its identify, its proposed uses, estimates of production levels, description of byproducts, adverse health and environmental data, and number of workers exposed to the chemicals. In addition, any person who manufactures, processes, or commercially distributes any chemical substance or mixture must keep records of significant adverse reactions to health or the environment allegedly caused by the chemical. Records concerning health effects on employees must be kept for 30 years; other records for five years. The Administrator may request any health and safety studies on specific chemicals known or available to any person who manufactures, processes, or commercially distributes such chemicals. In addition, if such a person has information which indicates that a chemical presents a substantial risk of injury to health or the environment, he must notify the Administrator. Manufacturers of chemical mixtures and research chemicals and small manufacturers in many cases may be exempt from reporting and/or record-keeping requirements. (§ 8).

Citizens have several opportunities to participate in the control of toxic chemicals under the Act: (1) they may participate in the development of the numerous rules required under TSCA by filing written comments and taking part in rulemaking hearings (§§ 4(b)(5), 5(b)(4)(C), 6(c)(2) and (3)); (2) they may bring civil lawsuits to prevent any person from violating the Act or to compel the Administrator to perform any nondiscretionary duty required by the Act (§ 20); (3) they may petition the Administrator to issue, amend, or repeal a rule under the testing, reporting, or regulatory sections of the Act, with the Administrator having 90 days to respond (§ 21); and (4) they may supply the Administrator with information indicating that there may be a reasonable basis to conclude that a chemical substance or mixture presents or will present a significant risk of serious or widespread harm to human beings from cancer, gene mutations, or birth defects, with the Administrator having 180 days (which may be extended for up to an additional 90 days) to respond either with appropriate remedial action or with a Federal Register notice concluding that the risk is not unreasonable (§ 4(f)(2). The Act authorizes courts to award reasonable litigation costs and attorney's fees, if appropriate, where court action is taken under the citizen suit or citizen petition provision of TSCA. (§§ 20(c)(2), 21(b)(4)(C)). The Administrator may also provide compensation of attorney and witness fees and other costs of participating in a rulemaking proceeding to regulate particular toxic chemicals under § 6(a) of the Act. (§ 6(c)(4)).

With certain exceptions (which may be waived), TSCA does not affect the authority of any State or locality to continue to enforce its own controls on toxic chemicals. The exceptions are that a State or locality may not continue to impose testing requirements for similar purposes once EPA has promulgated testing requirements, and that a State or locality may not impose environmental controls on the manufacture, processing, or commercial distribution (but not on other uses) of a chemical which differ from those promulgated by EPA. (§ 18). EPA may make grants to States for the establishment and operation of programs to prevent or eliminate unreasonable risks within the State to health or the environment which are associated with a chemical substance, where the Administrator is unable or is not likely to take such action under the Act, and where such State efforts will complement EPA actions or authority under the Act. (§ 28).

Although there is a general presumption of public access to any information generated in implementing the Act, § 14 does require the Administrator to protect confidential data, such as trade secrets and privileged financial data, from disclosure. All health and safety information on chemicals in commerce submitted under the Act is, however, subject to disclosure. (§ 14).

15-18. Transportation of Toxic and Hazardous Substances—various statutes, including Act of June 25, 1948, 62 Stat. 738, as amended in 1960, 1965, and 1978, 18 U.S.C. § 831, *et seq.;* Act of February 28, 1871, 16 Stat. 441, as repeatedly amended, 46 U.S.C. § 170; Act of January 3, 1975, 88 Stat. 2162, as amended, 49 U.S.C. § 1472(h); and the TRANSPORTATION SAFETY ACT OF 1974, as amended by the HAZARDOUS MATERIALS TRANSPORTATION ACT, Act of January 3, 1975, 88 Stat. 2156, and the HAZARDOUS MATERIALS TRANSPORTATION ACT AMENDMENTS OF 1976, Act of Oct. 1, 1976, 90 Stat. 2068, 49 U.S.C. § 1801, *et seq.*

Synopses—

(1) 18 U.S.C. § 831, *et seq.*—The Act authorizes the Department of Transportation to formulate regulations for the safe transportation of dangerous articles within the U.S., including radioactive materials, disease-causing agents, poisonous substances, flammable liquids and solids, oxidizing materials, corrosive liquids, and compressed gases. These regulations are binding upon all interstate commercial carriers or transporters of dangerous articles by land, and upon all shippers of dangerous articles by land or water (via any carrier engaged in interstate commerce). The Act also prohibits any person from delivering a dangerous article to a commercial carrier without either informing the carrier in writing of the true character of the article, or without plainly marking on the outside of every package containing dangerous articles the contents of such articles.

(2) 46 U.S.C. § 170—The Act prohibits the transportation or storage on any vessel on the navigable waters of the U.S. of dangerous articles or substances, including poisonous substances, hazardous articles, corrosive liquids, etc., except as permitted by Coast Guard regulations. The Act also provides for the Coast Guard to establish regulations regarding descriptive names, packing, marking, labeling, certification, specifications of containers, handling, storage, stowage, use, disposition (when found to be in an unsafe condition), and inspection of dangerous articles or substances on vessels covered by the Act.

(3) 49 U.S.C. § 1472(h)—This provision authorizes the Secretary of Transportation, in administering the Federal Aviation Program, to issue regulations providing for the safe transportation of hazardous materials by air. Persons who transport such materials in violation of any rule established by the Secretary are guilty of a criminal offense.

(4) Hazardous Materials Transportation Act, as amended, 49 U.S.C. § 1801, *et seq.*—The Act authorizes the Secretary of Transportation to issue regulations for the safe transportation in commerce of hazardous materials, which may govern any safety aspect of the transportation of such materials. These regulations must be applicable to any person who transports or ships a hazardous material, or who manufactures, marks, maintains, reconditions, repairs, or tests a package or container which is used in the commercial transportation of certain hazardous materials. The Secretary is also authorized to establish criteria for handling hazardous materials, which may include equipment to be used for detection, warning, and control of risks posed by such materials, and a system of monitoring safety assurance procedures for transportation of such materials. The Secretary may require covered hazardous material transporters, etc. to prepare and submit to the Secretary a registration statement which includes a complete list of all hazardous materials handled and the location of each activity handling such hazardous materials. "Hazardous materials" for purposes of this Act are particular quantities and forms of material which the Secretary determines may pose an unreasonable risk to health and safety or property when transported in commerce. The Act requires the Secretary to issue regulations prohibiting the transportation of radioactive materials on any passenger-carrying aircraft in air commerce, unless the materials involved are used in research or medical diagnosis or treatment.

VI-2 EPA Regional Toxic Substances Coordinators

Mr. Paul Heffernan
Toxic Substances Coordinator
EPA Region 1, Pesticide Branch
John F. Kennedy Federal Building
Boston, Massachusetts 02203
(617) 223-0585

Mr. Ralph Larsen
Toxic Substances Coordinator
EPA Region 2
26 Federal Plaza
New York, N.Y. 10007
(212) 264-1925

Mr. Chuck Sapp
Toxic Substances Coordinator
EPA Region 3, Pesticide Branch
Curtis Building
6th & Walnut Streets
Philadelphia, PA 19106
(215) 597-4058

Mr. Ralph Jennings
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EPA Region 4, Pesticide Branch
345 Courtland Street, N.E.
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(404) 881-3864

Mr. Karl Bremer
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EPA Region 5, Pesticide Branch
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(816) 374-6538

Mr. Dean Gillam
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EPA Region 8, Pesticide Branch
1860 Lincoln Street
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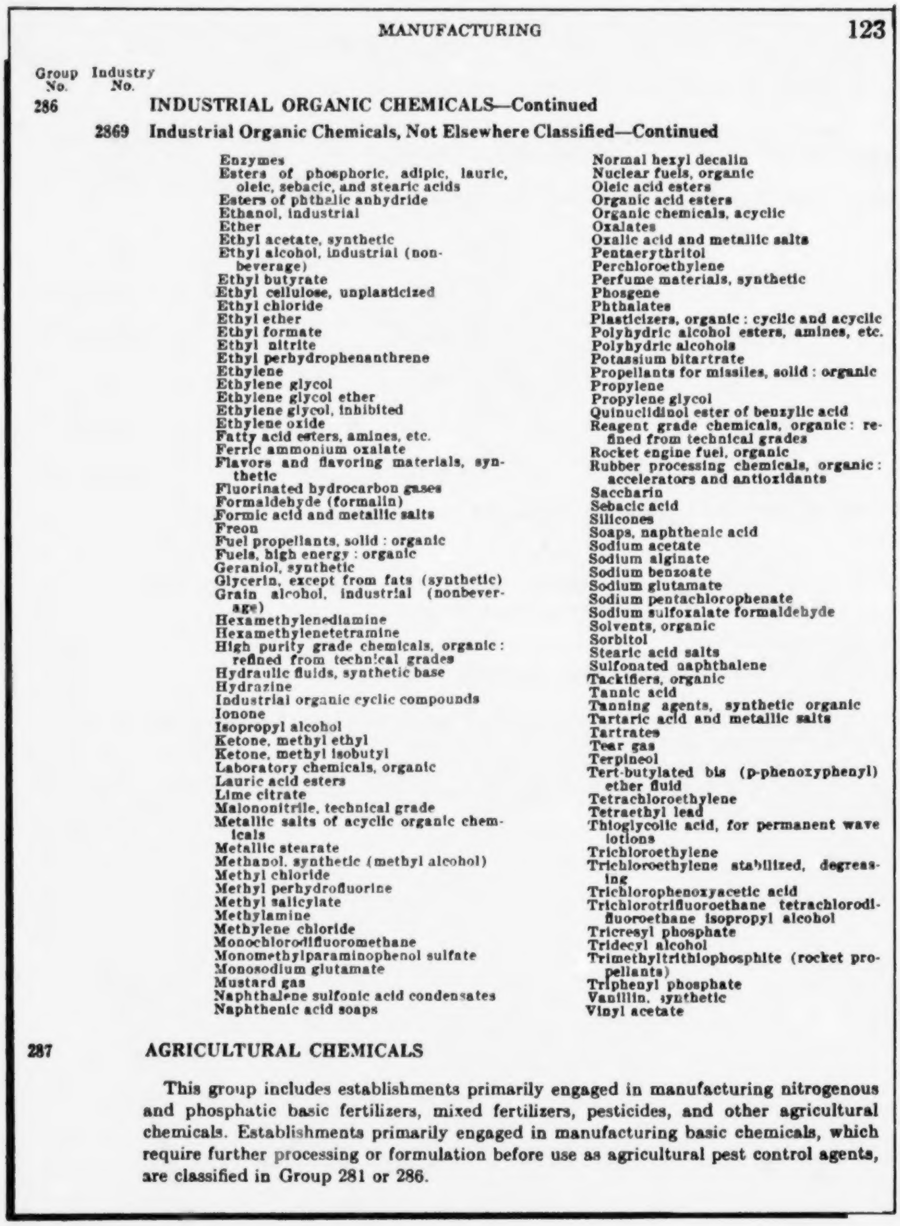
(303) 837-3926

Mr. Kirby Narcisse
Toxic Substances Coordinator
EPA Region 9, Pesticide Branch
215 Fremont Street
San Francisco, California 94105
(415) 556-4606

Mr. Jim Everts
Toxic Substances Coordinator
EPA Region 10, Pesticide Branch
1200 6th Avenue
Seattle, Washington 98101
(206) 442-1090

Appendix VII

VII-1 Standard Industrial Manual (Sample Page)



MANUFACTURING 123

Group No. Industry No.

286 **INDUSTRIAL ORGANIC CHEMICALS—Continued**

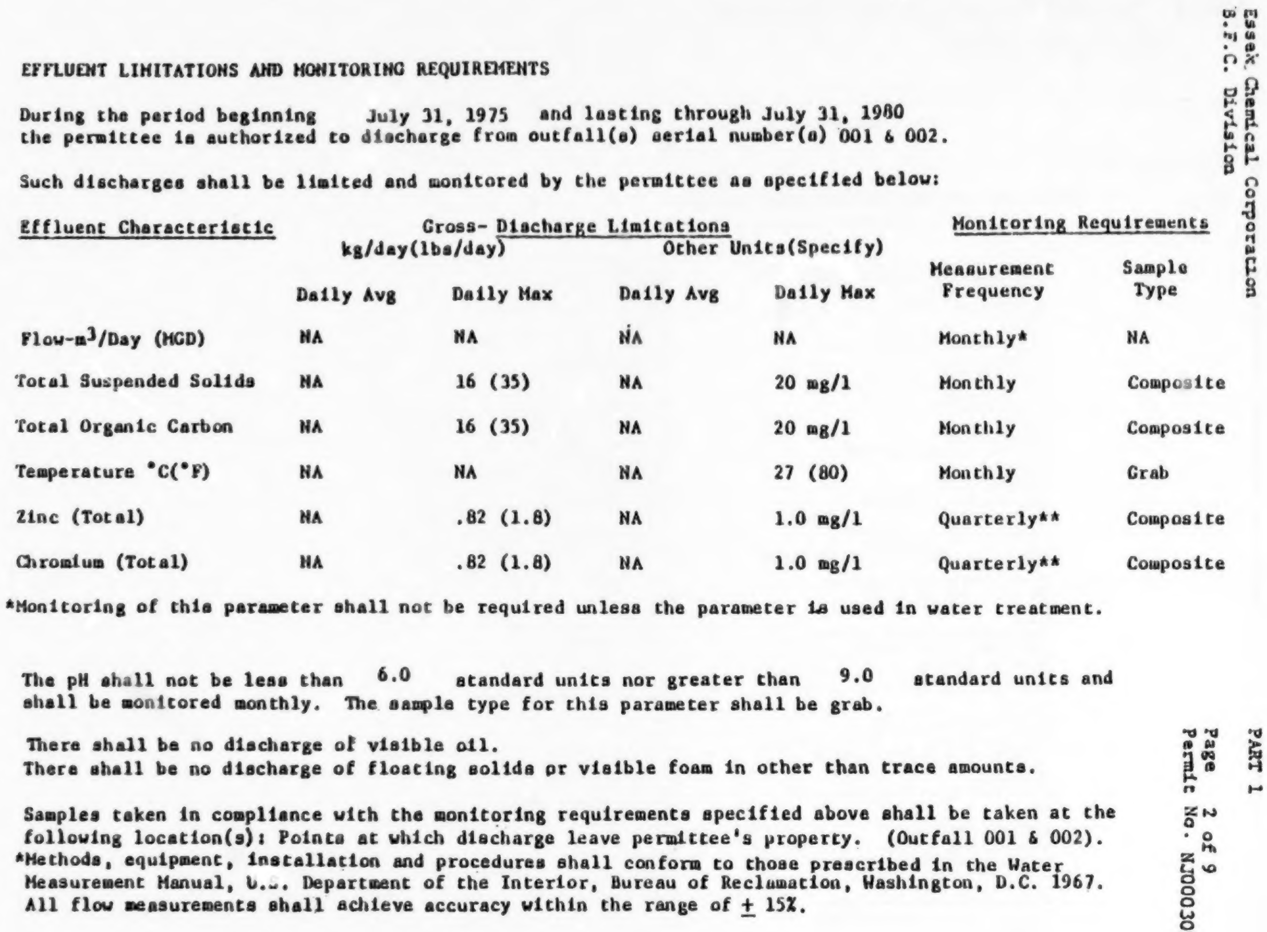
2869 **Industrial Organic Chemicals, Not Elsewhere Classified—Continued**

Enzymes
Esters of phosphoric, adipic, lauric, oleic, sebacic, and stearic acids
Esters of phthalic anhydride
Ethanol, industrial
Ether
Ethyl acetate, synthetic
Ethyl alcohol, industrial (nonbeverage)
Ethyl butyrate
Ethyl cellulose, unplasticized
Ethyl chloride
Ethyl ether
Ethyl formate
Ethyl nitrite
Ethyl perhydrophenanthrene
Ethylene
Ethylene glycol
Ethylene glycol ether
Ethylene glycol, inhibited
Ethylene oxide
Fatty acid esters, amines, etc.
Ferric ammonium oxalate
Flavors and flavoring materials, synthetic
Fluorinated hydrocarbon gases
Formaldehyde (formalin)
Formic acid and metallic salts
Freon
Fuel propellants, solid : organic
Fuels, high energy : organic
Geraniol, synthetic
Glycerin, except from fats (synthetic)
Grain alcohol, industrial (nonbeverage)
Hexamethylenediamine
Hexamethylenetetramine
High purity grade chemicals, organic : refined from technical grades
Hydraulic fluids, synthetic base
Hydrazine
Industrial organic cyclic compounds
Ionone
Isopropyl alcohol
Ketone, methyl ethyl
Ketone, methyl isobutyl
Laboratory chemicals, organic
Lauric acid esters
Lime citrate
Malononitrile, technical grade
Metallic salts of acyclic organic chemicals
Metallic stearate
Methanol, synthetic (methyl alcohol)
Methyl chloride
Methyl perhydrofluorine
Methyl salicylate
Methylamine
Methylene chloride
Monochlorodifluoromethane
Monomethylparaminophenol sulfate
Monosodium glutamate
Mustard gas
Naphthalene sulfonic acid condensates
Naphthenic acid soaps
Normal hexyl decalin
Nuclear fuels, organic
Oleic acid esters
Organic acid esters
Organic chemicals, acyclic
Oxalates
Oxalic acid and metallic salts
Pentaerythritol
Perchloroethylene
Perfume materials, synthetic
Phosgene
Phthalates
Plasticizers, organic : cyclic and acyclic
Polyhydric alcohol esters, amines, etc.
Polyhydric alcohols
Potassium bitartrate
Propellants for missiles, solid : organic
Propylene
Propylene glycol
Quinuclidinol ester of benzylic acid
Reagent grade chemicals, organic : refined from technical grades
Rocket engine fuel, organic
Rubber processing chemicals, organic : accelerators and antioxidants
Saccharin
Sebacic acid
Silicones
Soaps, naphthenic acid
Sodium acetate
Sodium alginate
Sodium benzoate
Sodium glutamate
Sodium pentachlorophenate
Sodium sulfoxalate formaldehyde
Solvents, organic
Sorbitol
Stearic acid salts
Sulfonated naphthalene
Tackifiers, organic
Tannic acid
Tanning agents, synthetic organic
Tartaric acid and metallic salts
Tartrates
Tear gas
Terpineol
Tert-butylated bis (p-phenoxyphenyl) ether fluid
Tetrachloroethylene
Tetraethyl lead
Thioglycolic acid, for permanent wave lotions
Trichloroethylene
Trichloroethylene stabilized, degreasing
Trichlorophenoxyacetic acid
Trichlorotrifluoroethane tetrachlorodifluoroethane isopropyl alcohol
Tricresyl phosphate
Tridecyl alcohol
Trimethyltrithiophosphite (rocket propellants)
Triphenyl phosphate
Vanillin, synthetic
Vinyl acetate

287 **AGRICULTURAL CHEMICALS**

This group includes establishments primarily engaged in manufacturing nitrogenous and phosphatic basic fertilizers, mixed fertilizers, pesticides, and other agricultural chemicals. Establishments primarily engaged in manufacturing basic chemicals, which require further processing or formulation before use as agricultural pest control agents, are classified in Group 281 or 286.

VII-2-a Effluent Limitations and Monitoring Requirements (Sample Page)



Essex Chemical Corporation
B.F.C. Division

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning July 31, 1975 and lasting through July 31, 1980 the permittee is authorized to discharge from outfall(s) serial number(s) 001 & 002.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Gross- Discharge Limitations kg/day(lbs/day)		Other Units(Specify)		Monitoring Requirements	
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-m^3/Day (MGD)	NA	NA	NA	NA	Monthly*	NA
Total Suspended Solids	NA	16 (35)	NA	20 mg/l	Monthly	Composite
Total Organic Carbon	NA	16 (35)	NA	20 mg/l	Monthly	Composite
Temperature °C(°F)	NA	NA	NA	27 (80)	Monthly	Grab
Zinc (Total)	NA	.82 (1.8)	NA	1.0 mg/l	Quarterly**	Composite
Chromium (Total)	NA	.82 (1.8)	NA	1.0 mg/l	Quarterly**	Composite

*Monitoring of this parameter shall not be required unless the parameter is used in water treatment.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored monthly. The sample type for this parameter shall be grab.

There shall be no discharge of visible oil.
There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Points at which discharge leave permittee's property. (Outfall 001 & 002).
*Methods, equipment, installation and procedures shall conform to those prescribed in the Water Measurement Manual, U.S. Department of the Interior, Bureau of Reclamation, Washington, D.C. 1967. All flow measurements shall achieve accuracy within the range of ± 15%.

PART 1
Page 2 of 9
Permit No. NJ0003093

VII-2-b NPDES Application

Form Approved
OMB No. 158-R0096

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
APPLICATION FOR PERMIT TO DISCHARGE - SHORT FORM C

FOR AGENCY USE

APPLICATION NUMBER
☐☐☐☐☐☐☐☐☐
DATE RECEIVED
YEAR / MO. / DAY

To be filed only by persons engaged in manufacturing and mining

Do not attempt to complete this form before reading accompanying instructions

Please print or type

1. Name, address, location, and telephone number of facility producing discharge
    - A. Name ____________________
    - B. Mailing address
        1. Street address ____________________
        2. City ____________________ 3. State ____________________
        4. County ____________________ 5. ZIP ____________________
    - C. Location:
        1. Street ____________________
        2. City ____________________ 3. County ____________________
        4. State ____________________
    - D. Telephone No. ______ ____________
      Area Code

2. SIC ☐☐☐☐
(Leave blank)

3. Number of employees ____________________

If all your waste is discharged into a publicly owned waste treatment facility and to the best of your knowledge you are not required to obtain a discharge permit, proceed to item 4. Otherwise proceed directly to item 5.

4. If you meet the condition stated above, check here ☐ and supply the information asked for below. After completing these items, please complete the date, title, and signature blocks below and return this form to the proper reviewing office without completing the remainder of the form.
    - A. Name of organization responsible for receiving waste ____________________
    - B. Facility receiving waste:
        1. Name ____________________
        2. Street address ____________________
        3. City ____________________ 4. County ____________________
        5. State ____________________ 6. ZIP ____________________

5. ☐ Principal product, ☐ raw material (Check one) ____________________

6. Principal process ____________________

7. Maximum amount of principal product produced or raw material consumed per (Check one)

Basis	Amount							
	1-99 (1)	100-199 (2)	200-499 (3)	500-999 (4)	1000-4999 (5)	5000-9999 (6)	10,000-49,999 (7)	50,000 or more (8)
A. Day								
B. Month								
C. Year								

EPA Form 7550-8 (1-73)

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8. Maximum amount of principal product produced or raw material consumed, reported in item 7, above, is measured in (Check one):
A. ☐ pounds B. ☐ tons C. ☐ barrels D. ☐ bushels E. ☐ square feet
F. ☐ gallons G. ☐ pieces or units H. ☐ other, specify ____________________

9. (a) Check here if discharge occurs all year ☐, or
(b) Check the month(s) discharge occurs:
1. ☐ January 2. ☐ February 3. ☐ March 4. ☐ April 5. ☐ May 6. ☐ June
7. ☐ July 8. ☐ August 9. ☐ September 10. ☐ October 11. ☐ November 12. ☐ December
(c) Check how many days per week: 1. ☐ 1 2. ☐ 2-3 3. ☐ 4-5 4. ☐ 6-7

10. Types of waste water discharged to surface waters only (check as applicable)

Discharge per operating day	Flow, operating gallons per day					Volume treated before discharging (percent)				
	0.1-999 (1)	1000-4999 (2)	5000-9999 (3)	10,000-49,999 (4)	50,000-or more (5)	None (6)	0.1-29.9 (7)	30-64.9 (8)	65-94.9 (9)	95-100 (10)
A. Sanitary, daily average										
B. Cooling water, etc. daily average										
C. Process water, daily average										
D. Maximum per operating day for total discharge (all types)										

11. If any of the three types of waste identified in item 9, either treated or untreated, are discharged to places other than surface waters, check below as applicable.

Waste water is discharged to:	Average flow, gallons per operating day				
	0.1-999 (1)	1000-4999 (2)	5000-9999 (3)	10,000-49,999 (4)	50,000 or more (5)
A. Municipal sewer system					
B. Underground well					
C. Septic tank					
D. Evaporation lagoon or pond					
E. Other, specify					

12. Number of separate discharge points: A. ☐ 1 B. ☐ 2-3 C. ☐ 4-5 D. ☐ 6 or more

13. Name of receiving water or waters ____________________

14. Does your discharge contain or is it possible for your discharge to contain one or more of the following substances added as a result of your operations, activities, or processes: ammonia, cyanide, aluminum, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, oil and grease, and chlorine (residual). A. ☐ yes B. ☐ no

I certify that I am familiar with the information contained in the application and that to the best of my knowledge and belief such information is true, complete, and accurate.

____________________ Printed Name of Person Signing

____________________ Title

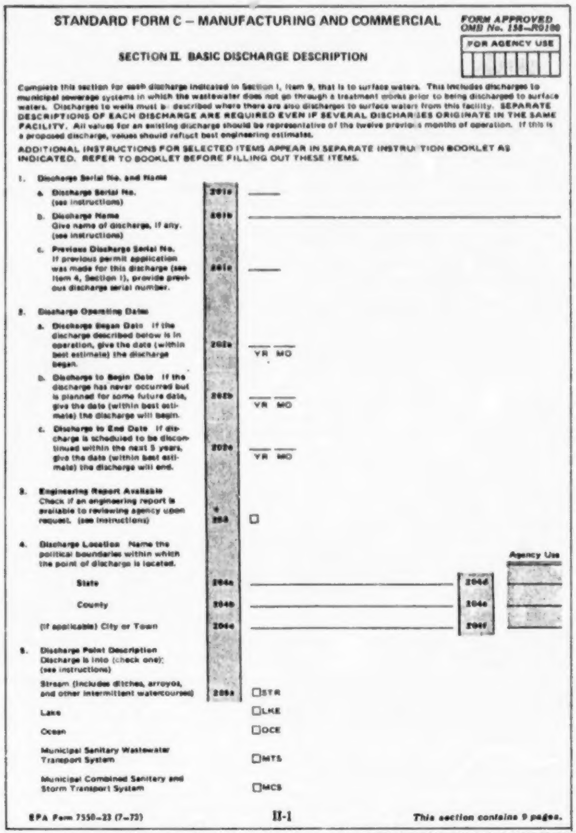
____________________ Date Application Signed

____________________ Signature of Applicant

18 U.S.C. Section 1001 provides that:
Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and wilfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious, or fraudulent statements or representations; or makes or uses any false writing or document knowing same to contain any false, fictitious, or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than 5 years, or both.

EPA Form 7550-8 (1-73) (Reverse)

VII-2-c NPDES Permit Application Standard Form (Sample)



STANDARD FORM C – MANUFACTURING AND COMMERCIAL

FORM APPROVED OMB No. 158–R0100

FOR AGENCY USE

SECTION II. BASIC DISCHARGE DESCRIPTION

Complete this section for each discharge indicated in Section I, Item 9, that is to surface waters. This includes discharges to municipal sewerage systems in which the wastewater does not go through a treatment works prior to being discharged to surface waters. Discharges to wells must be described where there are also discharges to surface waters from this facility. SEPARATE DESCRIPTIONS OF EACH DISCHARGE ARE REQUIRED EVEN IF SEVERAL DISCHARGES ORIGINATE IN THE SAME FACILITY. All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

1. **Discharge Serial No. and Name**
   - a. **Discharge Serial No.** (see instructions) 201a ______
   - b. **Discharge Name** Give name of discharge, if any. (see instructions) 201b ______
   - c. **Previous Discharge Serial No.** If previous permit application was made for this discharge (see Item 4, Section I), provide previous discharge serial number. 201c ______
2. **Discharge Operating Dates**
   - a. **Discharge Began Date** If the discharge described below is in operation, give the date (within best estimate) the discharge began. 202a ___ ___ YR MO
   - b. **Discharge to Begin Date** If the discharge has never occurred but is planned for some future date, give the date (within best estimate) the discharge will begin. 202b ___ ___ YR MO
   - c. **Discharge to End Date** If discharge is scheduled to be discontinued within the next 5 years, give the date (within best estimate) the discharge will end. 202c ___ ___ YR MO
3. **Engineering Report Available** Check if an engineering report is available to reviewing agency upon request. (see instructions) 203 ☐
4. **Discharge Location** Name the political boundaries within which the point of discharge is located.

Agency Use

State 204a ______ 204d

County 204b ______ 204e

(if applicable) City or Town 204c ______ 204f

5. **Discharge Point Description** Discharge is into (check one): (see instructions)

Stream (includes ditches, arroyos, and other intermittent watercourses) 205a ☐STR

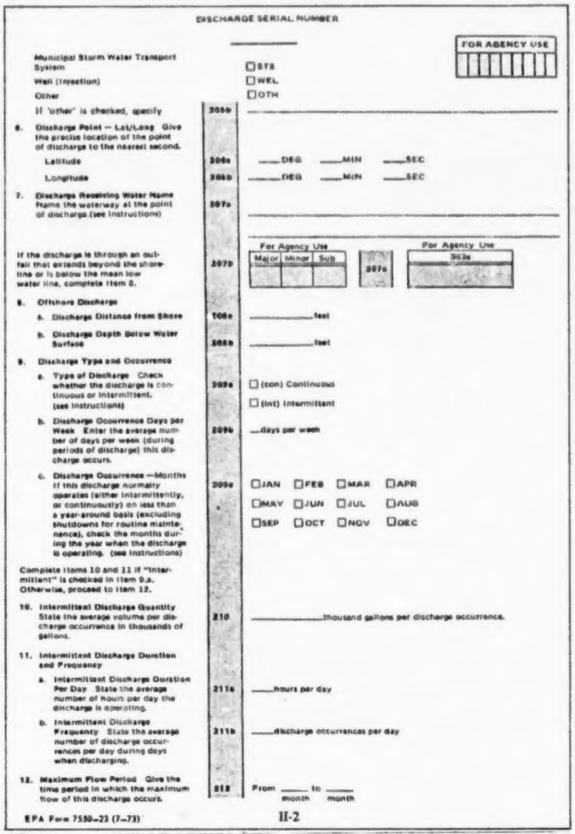
Lake ☐LKE

Ocean ☐OCE

Municipal Sanitary Wastewater Transport System ☐MTS

Municipal Combined Sanitary and Storm Transport System ☐MCS

EPA Form 7550–23 (7–73) II-1 *This section contains 9 pages.*



DISCHARGE SERIAL NUMBER

______

FOR AGENCY USE

Municipal Storm Water Transport System ☐STS

Well (Injection) ☐WEL

Other ☐OTH

If 'other' is checked, specify 205b ______

6. **Discharge Point — Lat/Long** Give the precise location of the point of discharge to the nearest second.

Latitude 206a ___DEG ___MIN ___SEC

Longitude 206b ___DEG ___MIN ___SEC

7. **Discharge Receiving Water Name** Name the waterway at the point of discharge (see instructions) 207a ______

If the discharge is through an outfall that extends beyond the shoreline or is below the mean low water line, complete Item 8. 207b

For Agency Use		
Major	Minor	Sub

207c

For Agency Use [illegible]

8. **Offshore Discharge**
   - a. **Discharge Distance from Shore** 208a ______feet
   - b. **Discharge Depth Below Water Surface** 208b ______feet
9. **Discharge Type and Occurrence**
   - a. **Type of Discharge** Check whether the discharge is continuous or intermittent. (see instructions) 209a ☐ (con) Continuous ☐ (int) Intermittent
   - b. **Discharge Occurrence Days per Week** Enter the average number of days per week (during periods of discharge) this discharge occurs. 209b ___days per week
   - c. **Discharge Occurrence —Months** If this discharge normally operates (either intermittently, or continuously) on less than a year-around basis (excluding shutdowns for routine maintenance), check the months during the year when the discharge is operating. (see instructions) 209c

☐JAN ☐FEB ☐MAR ☐APR

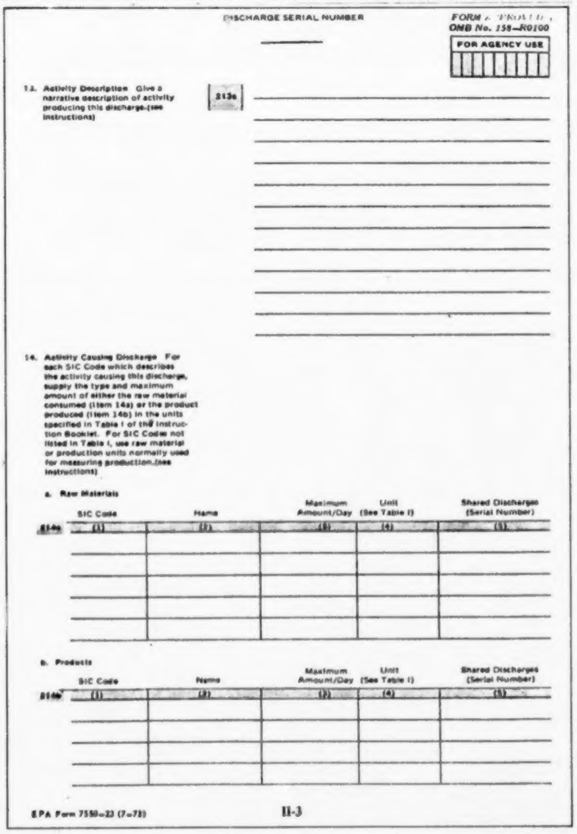
☐MAY ☐JUN ☐JUL ☐AUG

☐SEP ☐OCT ☐NOV ☐DEC

Complete items 10 and 11 if "intermittent" is checked in item 9.a. Otherwise, proceed to item 12.

10. **Intermittent Discharge Quantity** State the average volume per discharge occurrence in thousands of gallons. 210 ______thousand gallons per discharge occurrence.
11. **Intermittent Discharge Duration and Frequency**
    - a. **Intermittent Discharge Duration Per Day** State the average number of hours per day the discharge is operating. 211a ___hours per day
    - b. **Intermittent Discharge Frequency** State the average number of discharge occurrences per day during days when discharging. 211b ___discharge occurrences per day
12. **Maximum Flow Period** Give the time period in which the maximum flow of this discharge occurs. 212 From ___ to ___ month month

EPA Form 7550–23 (7–73) II-2



DISCHARGE SERIAL NUMBER

______

FORM APPROVED OMB No. 158–R0100

FOR AGENCY USE

13. **Activity Description** Give a narrative description of activity producing this discharge. (see instructions) 213a ______
14. **Activity Causing Discharge** For each SIC Code which describes the activity causing this discharge, supply the type and maximum amount of either the raw material consumed (item 14a) or the product produced (item 14b) in the units specified in Table I of the Instruction Booklet. For SIC Codes not listed in Table I, use raw material or production units normally used for measuring production. (see instructions)

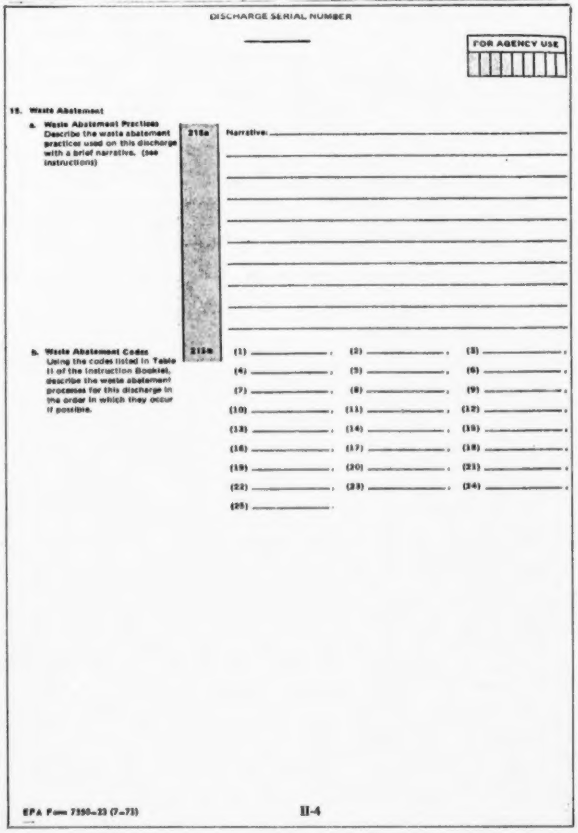
a. **Raw Materials**

	SIC Code	Name	Maximum Amount/Day	Unit (See Table I)	Shared Discharges (Serial Number)
214a	(1)	(2)	(3)	(4)	(5)

b. **Products**

	SIC Code	Name	Maximum Amount/Day	Unit (See Table I)	Shared Discharges (Serial Number)
214b	(1)	(2)	(3)	(4)	(5)

EPA Form 7550–23 (7–73) II-3



DISCHARGE SERIAL NUMBER

______

FOR AGENCY USE

15. **Waste Abatement**
    - a. **Waste Abatement Practices** Describe the waste abatement practices used on this discharge with a brief narrative. (see instructions) 215a Narrative: ______
    - b. **Waste Abatement Codes** Using the codes listed in Table II of the Instruction Booklet, describe the waste abatement processes for this discharge in the order in which they occur if possible. 215b

(1) ______, (2) ______, (3) ______,

(4) ______, (5) ______, (6) ______,

(7) ______, (8) ______, (9) ______,

(10) ______, (11) ______, (12) ______,

(13) ______, (14) ______, (15) ______,

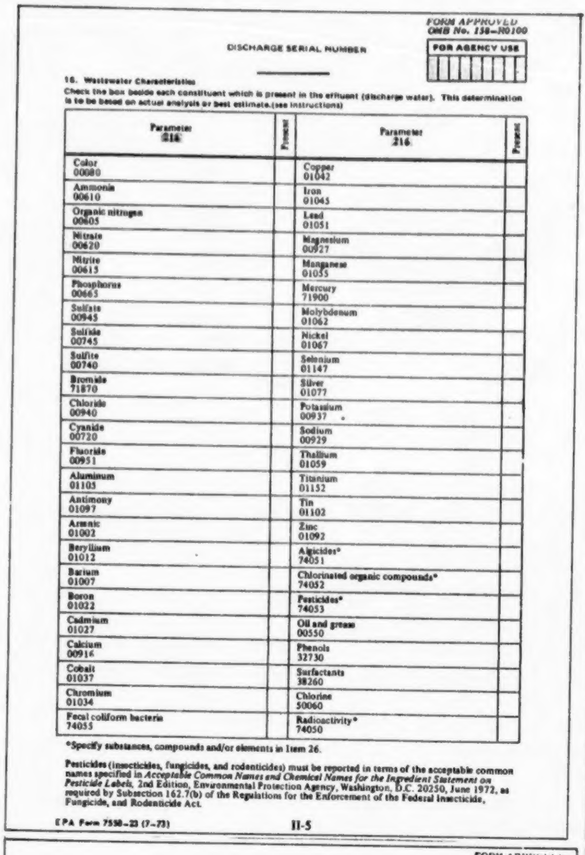
(16) ______, (17) ______, (18) ______,

(19) ______, (20) ______, (21) ______,

(22) ______, (23) ______, (24) ______,

(25) ______.

EPA Form 7550–23 (7–73) II-4



FORM APPROVED
OMB No. 158–R0100

DISCHARGE SERIAL NUMBER

FOR AGENCY USE

16. Wastewater Characteristics

Check the box beside each constituent which is present in the effluent (discharge water). This determination is to be based on actual analysis or best estimate.(see instructions)

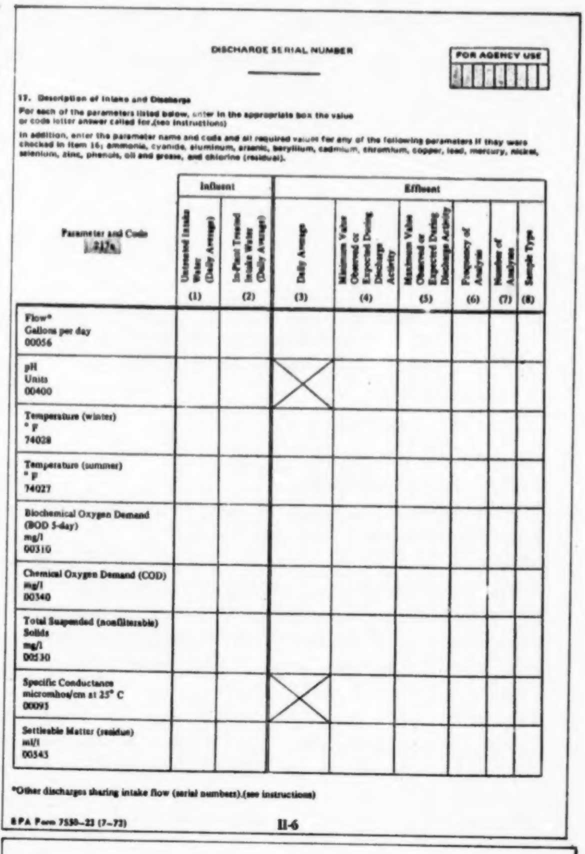
Parameter 216	Present	Parameter 216	Present
Color 00080		Copper 01042	
Ammonia 00610		Iron 01045	
Organic nitrogen 00605		Lead 01051	
Nitrate 00620		Magnesium 00927	
Nitrite 00615		Manganese 01055	
Phosphorus 00665		Mercury 71900	
Sulfate 00945		Molybdenum 01062	
Sulfide 00745		Nickel 01067	
Sulfite 00740		Selenium 01147	
Bromide 71870		Silver 01077	
Chloride 00940		Potassium 00937	
Cyanide 00720		Sodium 00929	
Fluoride 00951		Thallium 01059	
Aluminum 01105		Titanium 01152	
Antimony 01097		Tin 01102	
Arsenic 01002		Zinc 01092	
Beryllium 01012		Algicides* 74051	
Barium 01007		Chlorinated organic compounds* 74052	
Boron 01022		Pesticides* 74053	
Cadmium 01027		Oil and grease 00550	
Calcium 00916		Phenols 32730	
Cobalt 01037		Surfactants 38260	
Chromium 01034		Chlorine 50060	
Fecal coliform bacteria 74055		Radioactivity* 74050	

*Specify substances, compounds and/or elements in Item 26.

Pesticides (insecticides, fungicides, and rodenticides) must be reported in terms of the acceptable common names specified in *Acceptable Common Names and Chemical Names for the Ingredient Statement on Pesticide Labels,* 2nd Edition, Environmental Protection Agency, Washington, D.C. 20250, June 1972, as required by Subsection 162.7(b) of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.

EPA Form 7550–23 (7–73)

II-5



DISCHARGE SERIAL NUMBER

FOR AGENCY USE

17. Description of Intake and Discharge

For each of the parameters listed below, enter in the appropriate box the value or code letter answer called for.(see instructions)

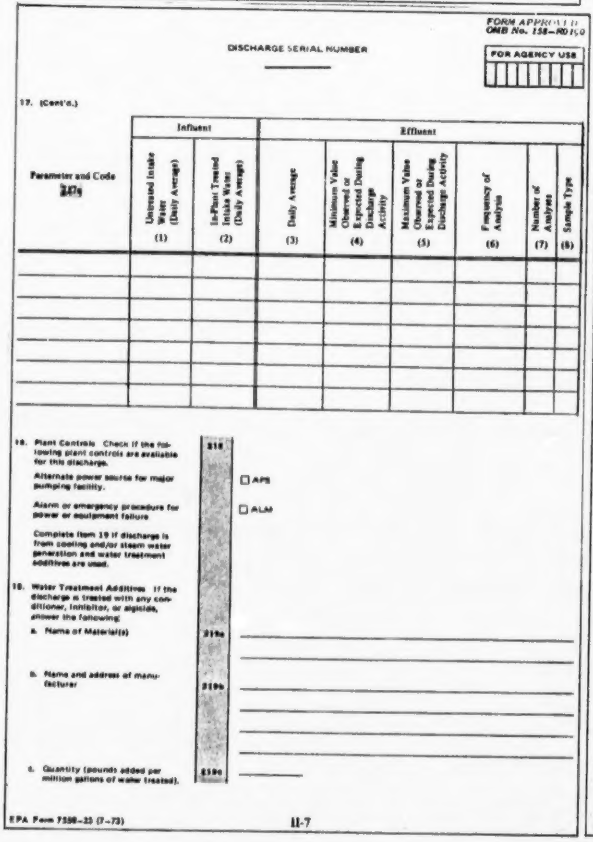
In addition, enter the parameter name and code and all required values for any of the following parameters if they were checked in Item 16; ammonia, cyanide, aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, oil and grease, and chlorine (residual).

Parameter and Code 217a	Influent		Effluent					
	Untreated Intake Water (Daily Average) (1)	In-Plant Treated Intake Water (Daily Average) (2)	Daily Average (3)	Minimum Value Observed or Expected During Discharge Activity (4)	Maximum Value Observed or Expected During Discharge Activity (5)	Frequency of Analysis (6)	Number of Analyses (7)	Sample Type (8)
Flow* Gallons per day 00056								
pH Units 00400								
Temperature (winter) ° F 74028								
Temperature (summer) ° F 74027								
Biochemical Oxygen Demand (BOD 5-day) mg/l 00310								
Chemical Oxygen Demand (COD) mg/l 00340								
Total Suspended (nonfilterable) Solids mg/l 00530								
Specific Conductance micromhos/cm at 25° C 00095								
Settleable Matter (residue) ml/l 00545								

*Other discharges sharing intake flow (serial numbers).(see instructions)

EPA Form 7550–23 (7–73)

II-6



FORM APPROVED
OMB No. 158–R0100

DISCHARGE SERIAL NUMBER

FOR AGENCY USE

17. (Cont'd.)

Parameter and Code 217b	Influent		Effluent					
	Untreated Intake Water (Daily Average) (1)	In-Plant Treated Intake Water (Daily Average) (2)	Daily Average (3)	Minimum Value Observed or Expected During Discharge Activity (4)	Maximum Value Observed or Expected During Discharge Activity (5)	Frequency of Analysis (6)	Number of Analyses (7)	Sample Type (8)

18. Plant Controls Check if the following plant controls are available for this discharge. 218

Alternate power source for major pumping facility. ☐ APS

Alarm or emergency procedure for power or equipment failure ☐ ALM

Complete Item 19 if discharge is from cooling and/or steam water generation and water treatment additives are used.

19. Water Treatment Additives If the discharge is treated with any conditioner, inhibitor, or algicide, answer the following:

a. Name of Material(s) 219a ______

b. Name and address of manufacturer 219b ______

c. Quantity (pounds added per million gallons of water treated). 219c ______

EPA Form 7550–23 (7–73)

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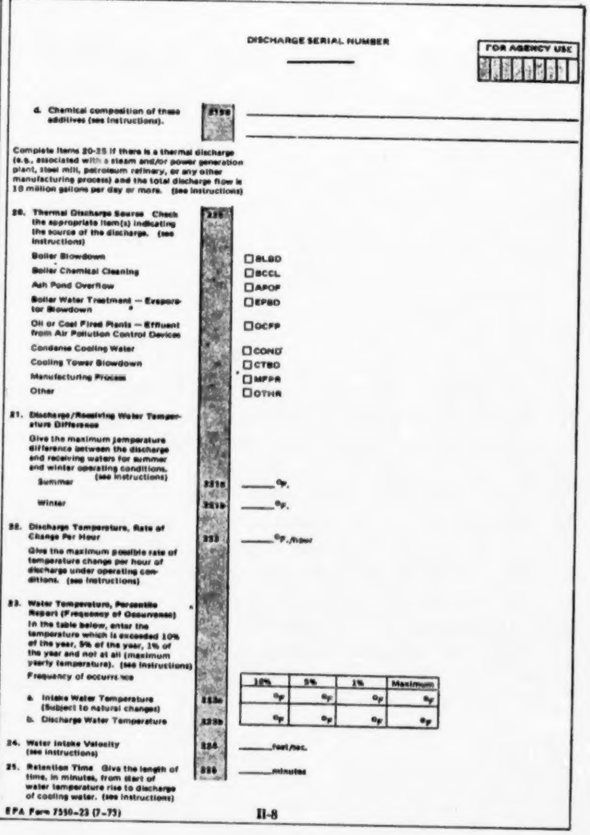


DISCHARGE SERIAL NUMBER

FOR AGENCY USE

d. Chemical composition of these additives (see instructions). 219d ______

Complete Items 20-25 if there is a thermal discharge (e.g., associated with a steam and/or power generation plant, steel mill, petroleum refinery, or any other manufacturing process) and the total discharge flow is 10 million gallons per day or more. (see instructions)

20. Thermal Discharge Source Check the appropriate item(s) indicating the source of the discharge. (see instructions) 220

Boiler Blowdown ☐ BLBD

Boiler Chemical Cleaning ☐ BCCL

Ash Pond Overflow ☐ APOF

Boiler Water Treatment — Evaporator Blowdown ☐ EPBD

Oil or Coal Fired Plants — Effluent from Air Pollution Control Devices ☐ OCFP

Condense Cooling Water ☐ COND

Cooling Tower Blowdown ☐ CTBD

Manufacturing Process ☐ MFPR

Other ☐ OTHR

21. Discharge/Receiving Water Temperature Difference

Give the maximum temperature difference between the discharge and receiving waters for summer and winter operating conditions. (see instructions)

Summer 221a ______°F.

Winter 221b ______°F.

22. Discharge Temperature, Rate of Change Per Hour 222 ______°F./hour

Give the maximum possible rate of temperature change per hour of discharge under operating conditions. (see instructions)

23. Water Temperature, Percentile Report (Frequency of Occurrence)

In the table below, enter the temperature which is exceeded 10% of the year, 5% of the year, 1% of the year and not at all (maximum yearly temperature). (see instructions)

Frequency of occurrence

a. Intake Water Temperature (Subject to natural changes) 223a

b. Discharge Water Temperature 223b

10%	5%	1%	Maximum
°F	°F	°F	°F
°F	°F	°F	°F

24. Water Intake Velocity (see instructions) 224 ______feet/sec.

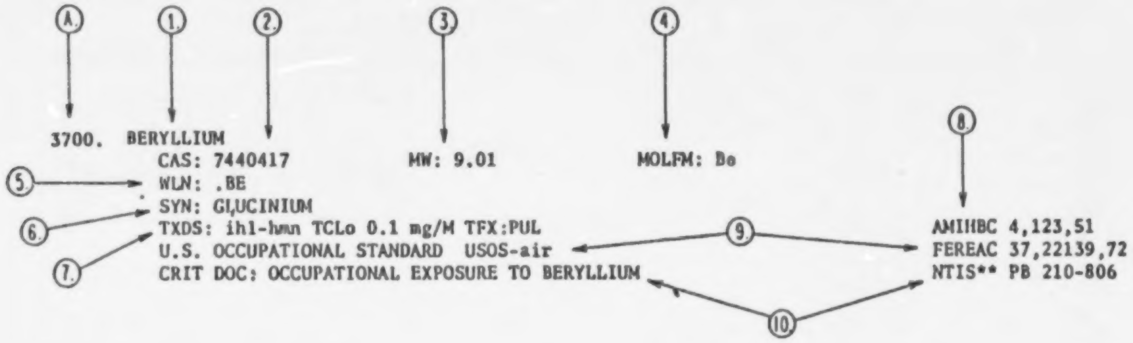
25. Retention Time Give the length of time, in minutes, from start of water temperature rise to discharge of cooling water. (see instructions) 225 ______minutes

EPA Form 7550–23 (7–73)

II-8

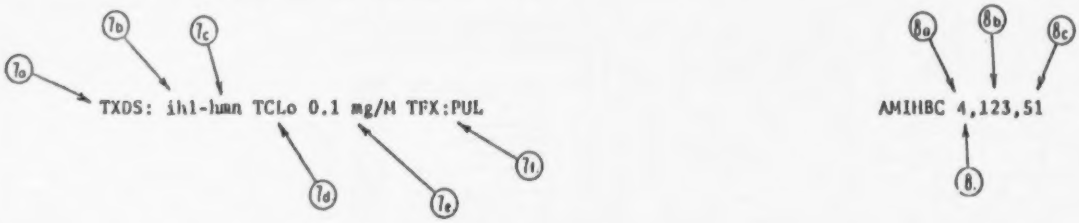
Appendix VIII

VIII-1-a An example of a typical entry in the Toxic Substances List.


Ⓐ
①
②
③
④
⑧
3700. BERYLLIUM
CAS: 7440417
MW: 9.01
MOLFM: Be
⑤
WLN: .BE
SYN: GLUCINIUM
⑥
TXDS: ihl-hmn TCLo 0.1 mg/M TFX:PUL
⑦
U.S. OCCUPATIONAL STANDARD USOS-air
⑨
CRIT DOC: OCCUPATIONAL EXPOSURE TO BERYLLIUM
AMIHBC 4,123,51
FEREAC 37,22139,72
NTIS** PB 210-806
⑩

A. Sequence number of this listing.
1. Prime name of compound.
2. Chemical Abstracts Registry Number, which is a number assigned to this compound so that it may be uniquely identified.
3. Molecular Weight of this compound.
4. Molecular Formula or Elemental Formula of this compound.
5. Wiswesser Line Notation, which is a formula defining the structure of this compound.
6. Synonyms, common names, trade names, and other chemical names.
7. Toxic dose line, which defines the route of administration or entry of this substance, the species involved, the type of dose reported, the dose which caused the toxic response, and the type of toxic response noted from the dose administered.
8. This is the reference to the original article or source from which the toxic data was derived.
9. U.S. Occupational Standard exists for this substance in the regulations of OSHA, U.S. Department of Labor. The standard may be found in the Federal Register referenced here.
10. A Criteria Document supporting a recommended standard has been published by NIOSH, U.S. Department of Health, Education and Welfare. The reference contains the published Criteria Document.

VIII-1-b A typical toxic dose line from the Toxic Substances List


7a
7b
7c
TXDS: ihl-hmn TCLo 0.1 mg/M TFX:PUL
7d
7e
7f
8a
8b
8c
AMIHBC 4,123,51
8

7a. An acronym which stands for "Toxic Dose".
7b. This is an abbreviation for the route of administration or entry of this substance.
7c. This is an abbreviation for the species.
7d. This is the type of dose reported.
7e. This is the dose which caused the toxic effect.
7f. The first part of this notation, "TFX", is an acronym which stands for "Toxic Effects". The last part of this notation refers to the organ system affected by the dose administered.
8. This is a code denoting the reference from which the toxic data was derived.
8a. Volume number of the reference.
8b. Page number of the reference.
8c. These two digits stand for the year of publication, i.e. 1951.

VIII-1-c Routes of Administration to, or Exposure of, Animal Species to Toxic Substances

Route	Abbreviation	Definition
Intracerebral	ice	administration into the cerebrum
Intracervical	icv	administration into the cervix
Intradermal	idr	administration within the dermis by hypodermic needle
Intraduodenal	idu	administration into the duodenum
Inhalation	ihl	inhalation in chamber, by cannulation, or through mask
Implant	imp	placed surgically within the body —location described in reference
Intramuscular	ims	administration of dose into the muscle by hypodermic needle
Intraplacental	ipc	administration into the placenta
Intrapleural	ipl	administration of dose into the pleural cavity by hypodermic needle
Intraperitoneal	ipr	administration into the peritoneal cavity
Intrarenal	irn	administration into the kidney
Intratracheal	itr	administration into the trachea
Intravaginal	ivg	administration into the vagina
Intravenous	ivn	administration of dose directly into the vein by hypodermic needle
Ocular	ocu	administration directly onto the surface of the eye or into the conjunctival sac
Oral	orl	per os, intragastric, feeding introduction with drinking water
Parenteral	par	administration into the body through the skin. Reference cited is not specific concerning the route used. Could be ipr, scu, ivn, ipl, ims, irn, or ice
Rectal	rec	administration of dose by way of rectum to the rectum or colon in form of enema, suppository
Skin	skn	application to the intact skin, dermal, cutaneous
Subcutaneous	scu	administration under the skin
Unreported	unk	dose, but not route, is specified in the reference

VIII-1-d Order of Preference for Data Acquisition for Certain Species

Species	Order of Preference for Data Acquisition	Designation
bird—any domestic or laboratory bird reported but not otherwise identified	22	brd
bird—wild bird species	23	bdw
cat	7	cat
cattle	11	ctl
chicken	17	ckn
dog	4	dog
domestic animals: goat, sheep, horse	12	dom
duck (domestic)	19	dck
frog	20	frg
gerbil	13	grb
guinea pig	9	gpg
hamster	10	ham
human	1	hmn
infant	1	inf
mammal—species unspecified in reference	15	mam
man	1	man
monkey	6	mky
mouse	3	mus
pig	8	pig
pigeon	16	pgn
quail (laboratory)	18	qal
rabbit	5	rbt
rat	2	rat
squirrel	14	sql
toad	20	tod
turkey	21	trk
woman	1	wmn

VIII-1-e Assumptions for Toxic Dose Calculation from Non-specific Data*

Species	Age	Weight	Consumption Food gm/day	Water ml/day (Approx.)
Cat, adult		2 kg	100	100
Chicken, adult (male or female)	8 W	500 gm	200	200
Dog, adult	52 W	10 kg	250	500
Duck, adult (domestic)	8 W	2.5 kg	250	500
Frog, adult		33 gm		
Guinea pig, adult		500 gm	30	85
Hamster	14 W	125 gm	15	85
Monkey	2.5 Y	5 kg	400	500
Mouse	8 W	25 gm	5	5
Pigeon	8 W	500 gm		
Rabbit, adult	12 W	2 kg	100	330
Rat, adult female	14 W	200 gm	10	20
Rat, adult male	14 W	250 gm	15	25
Rat, adult sex unspecified	14 W	200 gm	15	25
Rat, weanling	3 W	50 gm	15	25

*NOTE: Values given here are within reasonable limits usually found in the published literature and are selected to facilitate calculations for data from publications in which toxic dose information has not been presented for an individual animal of the study. Data for lifetime exposure are calculated from the assumptions for adult animals for the entire period of exposure. For definitive dose data the reader must review the referenced publication.

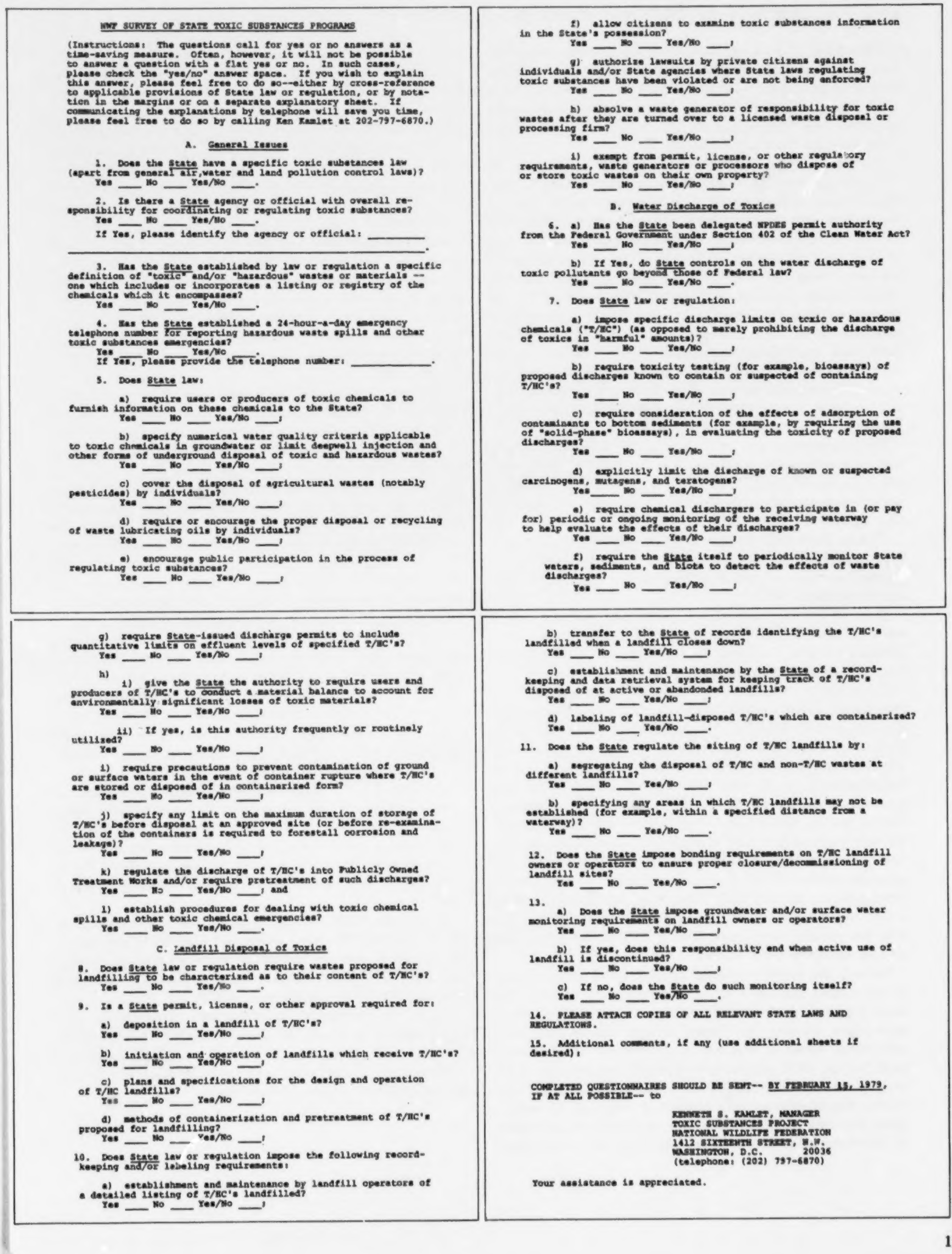
Units of Time for Dose Administration

Unit	Abbreviation	Limits of Use and Definitions
Minute	M	1-99 minutes
Hour	H	1-99 hours
Day	D	2-99 Days
Week	W	2-99 Weeks
Year	Y	1-99 Years
Continuous	C	Indicates that the exposure was continuous over the time administered, such as ad lib feeding exposures or twenty-four hour, seven-day week inhalation exposures.
Intermittent	I	Indicates that the dose was administered during discretely separate periods, such as daily parenteral, oral, or skin applications.

VIII-1-F Notations Descriptive of the Toxicology

Abbreviations	Definitions (not limited to effects listed)
ALR	Allergenic-systemic reaction such as might be experienced by individuals sensitized to penicillin.
BCM	Blood clotting mechanism—any effect which increases or decreases clotting time.
BLD	Blood effects—effect on all blood elements, electrolytes, pH, protein, oxygen-carrying or releasing capacity.
BPR	Blood pressure effects—any effect which changes any aspect of blood pressure away from normal—incresed or decreased.
CAR	Carcinogenic—producing cancer—a cellular tumor, the nature of which is fatal or is associated with the formation of secondary tumors (metastasis).
CNS	Central nervous system—includes effects such as headaches, tremor, drowsiness, convulsions, hypnosis, anesthesia.
COR	Corrosive effects—burns, desquamation.
CUM	Cumulative effect—where substance is retained by the body in greater quantities than is excreted, or the toxic effect is increased in severity by repeated bodily insult.
CVS	Cardiovascular effects—such as when heart activity is increased or decreased through an effect on ventricle or auricle; fibrillation; or when the arterial or venous system is dilated or constricted.
DDP	Drug dependence—any indication of addiction or dependence.
EYE	Eye effects—irritation, diploplia, cataracts, eye ground, blindness by affecting the eye or the optic nerve.
GIT	Gastrointestinal tract effects—diarrhea, constipation, ulceration.
GLN	Glandular effects—any effect on the endocrine glandular system.
IRR	Irritant effect—any effect on the skin, eye, or mucous membrane.
MMI	Mucous membrane effects—irritation, hyperplasia, ciliary activity changed.
MSK	Musculo-skeletal effects—such as osteoporosis, muscular degeneration.
MUT	Mutation or mutagenic—transmissible changes produced in the offspring.
NEO	Neoplastic effect—the production of tumors.
PNS	Peripheral nervous system effects.
PUL	Pulmonary system effects—effects on respiration and respiratory pathology.
RBC	Red blood cell effects—includes the several anemias.
SKN	Skin effects—such as erythema, rash, sensitization of skin, petechial hemorrhage.
SYS	Systemic effects—effects on the metabolic and excretory function of the liver or kidneys.
TER	Teratogenic effects—nontransmissible changes produced in the offspring.
TFX	Toxic effects—used to introduce the principal organ system affected as reported or the pathology.
UNS	Unspecified effects—the toxic effects were unspecified in source.
WBC	White blood cell effects—effects on any of the cellular units other than erythrocytes, including any change in number or form.

Appendix IX IX-1 NWF State Toxic Substances Survey Form



NWF SURVEY OF STATE TOXIC SUBSTANCES PROGRAMS

(Instructions: The questions call for yes or no answers as a time-saving measure. Often, however, it will not be possible to answer a question with a flat yes or no. In such cases, please check the "yes/no" answer space. If you wish to explain this answer, please feel free to do so--either by cross-reference to applicable provisions of State law or regulation, or by notation in the margins or on a separate explanatory sheet. If communicating the explanations by telephone will save you time, please feel free to do so by calling Ken Kamlet at 202-797-6870.)

A. General Issues

1. Does the State have a specific toxic substances law (apart from general air,water and land pollution control laws)?
Yes ____ No ____ Yes/No ____.

2. Is there a State agency or official with overall responsibility for coordinating or regulating toxic substances?
Yes ____ No ____ Yes/No ____.
If Yes, please identify the agency or official: __________
____.

3. Has the State established by law or regulation a specific definition of "toxic" and/or "hazardous" wastes or materials -- one which includes or incorporates a listing or registry of the chemicals which it encompasses?
Yes ____ No ____ Yes/No ____.

4. Has the State established a 24-hour-a-day emergency telephone number for reporting hazardous waste spills and other toxic substances emergencies?
Yes ____ No ____ Yes/No ____.
If Yes, please provide the telephone number: ____________.

5. Does State law:

a) require users or producers of toxic chemicals to furnish information on these chemicals to the State?
Yes ____ No ____ Yes/No ____;

b) specify numerical water quality criteria applicable to toxic chemicals in groundwater or limit deepwell injection and other forms of underground disposal of toxic and hazardous wastes?
Yes ____ No ____ Yes/No ____;

c) cover the disposal of agricultural wastes (notably pesticides) by individuals?
Yes ____ No ____ Yes/No ____;

d) require or encourage the proper disposal or recycling of waste lubricating oils by individuals?
Yes ____ No ____ Yes/No ____;

e) encourage public participation in the process of regulating toxic substances?
Yes ____ No ____ Yes/No ____;

f) allow citizens to examine toxic substances information in the State's possession?
Yes ____ No ____ Yes/No ____;

g) authorize lawsuits by private citizens against individuals and/or State agencies where State laws regulating toxic substances have been violated or are not being enforced?
Yes ____ No ____ Yes/No ____;

h) absolve a waste generator of responsibility for toxic wastes after they are turned over to a licensed waste disposal or processing firm?
Yes ____ No ____ Yes/No ____;

i) exempt from permit, license, or other regulatory requirements, waste generators or processors who dispose of or store toxic wastes on their own property?
Yes ____ No ____ Yes/No ____;

B. Water Discharge of Toxics

6. a) Has the State been delegated NPDES permit authority from the Federal Government under Section 402 of the Clean Water Act?
Yes ____ No ____ Yes/No ____;

b) If Yes, do State controls on the water discharge of toxic pollutants go beyond those of Federal law?
Yes ____ No ____ Yes/No ____.

7. Does State law or regulation:

a) impose specific discharge limits on toxic or hazardous chemicals ("T/HC") (as opposed to merely prohibiting the discharge of toxics in "harmful" amounts)?
Yes ____ No ____ Yes/No ____;

b) require toxicity testing (for example, bioassays) of proposed discharges known to contain or suspected of containing T/HC's?
Yes ____ No ____ Yes/No ____;

c) require consideration of the effects of adsorption of contaminants to bottom sediments (for example, by requiring the use of "solid-phase" bioassays), in evaluating the toxicity of proposed discharges?
Yes ____ No ____ Yes/No ____;

d) explicitly limit the discharge of known or suspected carcinogens, mutagens, and teratogens?
Yes____ No ____ Yes/No ____;

e) require chemical dischargers to participate in (or pay for) periodic or ongoing monitoring of the receiving waterway to help evaluate the effects of their discharges?
Yes ____ No ____ Yes/No ____;

f) require the State itself to periodically monitor State waters, sediments, and biota to detect the effects of waste discharges?
Yes ____ No ____ Yes/No ____;

g) require State-issued discharge permits to include quantitative limits on effluent levels of specified T/HC's?
Yes ____ No ____ Yes/No ____;

h)
i) give the State the authority to require users and producers of T/HC's to conduct a material balance to account for environmentally significant losses of toxic materials?
Yes ____ No ____ Yes/No ____;

ii) If yes, is this authority frequently or routinely utilized?
Yes ____ No ____ Yes/No ____;

i) require precautions to prevent contamination of ground or surface waters in the event of container rupture where T/HC's are stored or disposed of in containerized form?
Yes ____ No ____ Yes/No ____;

j) specify any limit on the maximum duration of storage of T/HC's before disposal at an approved site (or before re-examination of the containers is required to forestall corrosion and leakage)?
Yes ____ No ____ Yes/No ____;

k) regulate the discharge of T/HC's into Publicly Owned Treatment Works and/or require pretreatment of such discharges?
Yes ____ No ____ Yes/No ____; and

l) establish procedures for dealing with toxic chemical spills and other toxic chemical emergencies?
Yes ____ No ____ Yes/No ____.

C. Landfill Disposal of Toxics

8. Does State law or regulation require wastes proposed for landfilling to be characterized as to their content of T/HC's?
Yes ____ No ____ Yes/No ____.

9. Is a State permit, license, or other approval required for:

a) deposition in a landfill of T/HC's?
Yes ____ No ____ Yes/No ____;

b) initiation and operation of landfills which receive T/HC's?
Yes ____ No ____ Yes/No ____;

c) plans and specifications for the design and operation of T/HC landfills?
Yes ____ No ____ Yes/No ____;

d) methods of containerization and pretreatment of T/HC's proposed for landfilling?
Yes ____ No ____ Yes/No ____;

10. Does State law or regulation impose the following record-keeping and/or labeling requirements:

a) establishment and maintenance by landfill operators of a detailed listing of T/HC's landfilled?
Yes ____ No ____ Yes/No ____;

b) transfer to the State of records identifying the T/HC's landfilled when a landfill closes down?
Yes ____ No ____ Yes/No ____;

c) establishment and maintenance by the State of a record-keeping and data retrieval system for keeping track of T/HC's disposed of at active or abandonded landfills?
Yes ____ No ____ Yes/No ____;

d) labeling of landfill-disposed T/HC's which are containerized?
Yes ____ No ____ Yes/No ____.

11. Does the State regulate the siting of T/HC landfills by:

a) segregating the disposal of T/HC and non-T/HC wastes at different landfills?
Yes ____ No ____ Yes/No ____;

b) specifying any areas in which T/HC landfills may not be established (for example, within a specified distance from a waterway)?
Yes ____ No ____ Yes/No ____.

12. Does the State impose bonding requirements on T/HC landfill owners or operators to ensure proper closure/decommissioning of landfill sites?
Yes ____ No ____ Yes/No ____.

13.
a) Does the State impose groundwater and/or surface water monitoring requirements on landfill owners or operators?
Yes ____ No ____ Yes/No ____;

b) If yes, does this responsibility end when active use of landfill is discontinued?
Yes ____ No ____ Yes/No ____;

c) If no, does the State do such monitoring itself?
Yes ____ No ____ Yes/No ____.

14. PLEASE ATTACH COPIES OF ALL RELEVANT STATE LAWS AND REGULATIONS.

15. Additional comments, if any (use additional sheets if desired):

COMPLETED QUESTIONNAIRES SHOULD BE SENT-- BY FEBRUARY 15, 1979, IF AT ALL POSSIBLE-- to

KENNETH S. KAMLET, MANAGER
TOXIC SUBSTANCES PROJECT
NATIONAL WILDLIFE FEDERATION
1412 SIXTEENTH STREET, N.W.
WASHINGTON, D.C. 20036
(telephone: (202) 797-6870)

Your assistance is appreciated.

II-2 Discussion of Survey Results

The "NWF Survey of State Toxic Substances Programs" was sent to the Commissioners of State health and environmental agencies on January 3, 1979. Surveys were sent to all 50 States, to the District of Columbia, and to the territories of Guam, the Virgin Islands, and Puerto Rico. Responses were received from all recipients.

The first responses to be received arrived on January 12, 1979; the last response to arrive was received on May 7, 1979. Many States indicated that new hazardous waste laws or regulations were in the process of being adopted. However, all survey responses were evaluated and scored on the basis of State legal authorities existing as of the date of receipt of the survey response. A number of States might well have received higher rankings and scores than reflected in the present analysis had their toxic substances programs been evaluated on the basis of expected rather than existing legal authorities. Anticipated authorities were not taken into account, however, in the interest of evaluating all responses on a uniform basis and because of the uncertainties inherent in relying upon final legislative or administrative approval of not-yet-adopted legislation and regulations.

States indicating that their legislatures were considering new toxic substances legislation are: DC, GA, GU, ID(?), MA, MI, NC, TX, UT, VA, WY. States with pending hazardous waste management (or similar) regulations are: AL, AZ, CO, GU, IL, KY, LA, MN, MO, NJ, OH, PA, SC, TN, VT, WI.

Clearly, State toxic substances programs are presently in a high degree of flux. Readers desiring up-to-date information on the programs of particular States are encouraged to contact these States directly.

The NWF Survey provides a useful and accurate *general* measure of the status of State toxic substances programs, both individually and in relation to one another—as long as one bears in mind its limitations.

A few additional points are worth bearing in mind. First, a number of questions asked whether a particular approach was required by State law or regulation. In many cases, although no law or regulation requires the specified approach, the State imposes this approach anyway as a permit condition or under its discretionary authority. However, for purposes of designing the Survey questions, and in evaluating Survey results, States were given credit only for programs formally mandated by law or regulation—on the theory that discretionary authorities are too readily subject to change and are a less stable and valid measure of a State's overall, consistent approach toward toxic substances. Accordingly, States which rely heavily on discretionary authorities (NY may fall into this category) may have been judged too harshly in the scoring of the present survey.

Second, the questions asked for *State*-level requirements. In some cases, adequate measures which might exist at the local, regional, or Federal level are not reflected where a respondent answers "no" based on the lack of State-level authorities. Again, it was felt in the interest of uniformity (and because toxic and hazardous waste problems are often most effectively addressed at the State level) that the NWF Survey would address only State-level programs. In certain cases, this may result in too gloomy a picture being painted of the status of toxic substances regulation in certain States.

Care should be taken in making comparisons among States on the basis of NWF Survey results. Many survey questions were not susceptible to a clearcut yes or no answer. Some States were more candid and self-critical than others. And the individual respondents were of differing backgrounds and had varying degrees of familiarity with the nuances of their State programs (e.g., a lawyer might well respond to the same question differently from an engineer or an agency official). Indeed, in the few cases where multiple responses were received from the same State (i.e., where the State health department and the State environmental agency both responded—and obviously did so without coordinating their answers), different and even inconsistent answers were often given to the same survey questions. In these cases, the differences were often traceable to differing emphases placed by the respondent on various aspects of the question. States submitting multiple (i.e., two) responses were: MI, MO, MT, ID, WA, MD.

Subjective differences in interpreting Survey questions could not be totally eliminated. However, subjective factors were sought to be minimized by having the same individual score all Survey responses, by consulting State laws and regulations where necessary and, in some cases, contacting State officials to resolve uncertainties and ambiquities. To the extent that some subjectivity remains, this is not necessarily undesirable. After all, State laws and regulations can only be as effective as the officials interpreting and administering them. If a State official wrongly concludes that he lacks the legal authority to require an industrial discharger to monitor the receiving waterway, to all intents and purposes he lacks the authority, because he doesn't intend to use it.

Finally, it shold be remembered that the need for a strong toxic substances program is not equal among the States. States that are heavy generators of hazardous wastes (CA, IL, IN, MI, NJ, NY, OH, PA, TN, TX) would deserve far heavier condemnation for having an inadequate toxic substances program than States having little or no hazardous waste generating industry. The Survey received from Guam, for example, bore the following notation.

> "Guam has no hazardous waste landfill and does not want to have one as there are really no suitable sites available. At present we are working on a plan to ship them all off-island, a procedure which will probably have to be repeated every few years. Luckily, we produce very little in the way of toxic wastes, as we have no industry to speak of."

Guam ranked 54th among 54 States and territories. This is not as alarming, however, as the fact that Michigan, one of the country's heaviest hazardous waste generators, ranked 28th and Puerto Rico (which is home to many chemical and pharmaceutical companies) ranked 47th.

All in all, bearing all of the above qualifications and considerations in mind, one must conclude that the Kepone contamination problem and the situations at Love Canal and "Valley of the Drums" could readily occur again at any time almost anywhere in the United States.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1980 620-228/4089

IX-3 Table of Corrected Toxic Substances

	1	2	3	4	5a	b	c	d	e	f	g	h	i	6a	b	7a	b	c	d	e	f	g	h(i)	h(ii)	i	j	k	l	8	9a	b	c	d	10a	b	c	d	11a	b	12	13a	b*	c
AL	-	-	-	+	-	-	+	-	0	+	-	0	+	-	NA	0	0	0	-	-	+	0	0	NA	0	0	+	0	+	+	+	+	+	0	0	0	0	+	+	0	0	0	0
AK	-	-	-	-	-	+	+	+	+	+	-	-	+	-	NA	+	-	-	-	-	-	-	-	NA	0	-	+	+	+	+	+	0	-	0	-	-	-	+	+	-	+	0	NA
AZ	-	-	-	-	-	-	+	-	0	+	-	+	+	-	NA	-	-	-	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
AR	-	-	-	+	0	-	+	-	0	+	+	+	+	-	NA	-	+	-	-	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	-	-	-	+	-	-	+	0	NA
CA	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	-	0	+	+	+	+	-	+	-	-	+	+	+	+	+	+	+	-	+	0	+	+	+	+	+	-
CO	-	-	-	-	-	+	-	0	0	+	-	+	-	+	0	+	-	-	-	-	+	+	-	NA	+	-	0	0	-	0	+	+	-	-	-	-	-	-	0	-	+	+	-
CT	0	+	0	+	-	+	0	0	0	0	0	0	0	+	0	0	0	0	+	-	+	+	+	+	+	-	+	+	0	+	+	0	+	-	-	-	0	+	+	-	0	0	0
DC	-	+	-	+	-	+	+	+	+	+	-	-	+	-	NA	-	+	-	-	-	+	-	-	NA	+	-	-	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DE	-	+	-	+	-	+	-	-	+	+	+	+	+	+	0	-	+	-	-	-	+	+	-	NA	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
FL	-	0	-	+	-	+	-	0	+	+	+	+	+	-	NA	0	-	-	+	-	+	+	-	NA	-	-	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-
GA	-	-	-	+	-	+	0	0	0	+	-	+	0	+	-	NA	NA	NA	NA	NA	NA	NA	+	-	+	-	+	+	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GU	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	-	-	0	-	-	-	-	+	-	-	-	-	-	-	-	-	0	+	NA
HI	-	-	-	-	0	-	+	-	+	0	-	+	+	+	-	0	+	-	-	+	-	0	-	NA	-	-	-	-	0	+	+	+	0	-	-	-	-	+	+	-	0	+	0
ID	-	-	-	-	-	0	-	-	0	0	-	NA	+	-	NA	NA	-	-	-	-	+	-	-	NA	0	-	-	-	0	+	+	+	-	+	+	-	-	0	0	0	0	-	-
IL	-	-	-	+	-	-	+	+	+	+	+	+	+	0	0	0	-	-	-	-	+	+	-	NA	+	-	+	-	+	+	+	+	+	-	-	+	-	0	+	-	+	+	-
IN	-	-	-	+	-	0	-	-	+	+	+	+	+	+	+	+	0	-	-	0	-	-	+	-	-	-	+	+	-	+	+	+	0	-	-	-	-	+	-	-	+	+	-
IA	-	-	-	+	-	0	0	-	-	+	-	+	0	+	-	+	-	-	-	-	-	+	+	-	+	-	+	+	0	+	+	+	+	-	-	-	-	-	0	-	+	-	NA
KS	-	-	0	-	-	+	+	+	-	+	-	-	+	+	-	-	-	-	-	-	0	-	-	NA	+	-	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	NA
KY	-	0	-	+	-	0	0	NA	+	0	NA	+	-	-	NA	-	-	-	-	0	+	0	-	NA	+	NA	0	+	+	+	+	+	+	-	-	-	-	-	-	-	0	-	0
LA	-	+	+	-	+	+	+	-	+	+	-	+	+	-	NA	-	-	-	-	-	+	-	+	NA	-	-	0	-	+	+	+	+	+	+	0	+	+	+	+	-	+	-	-
ME	+	0	-	0	-	-	+	-	-	+	0	+	+	-	-	-	-	-	-	-	-	-	-	NA	+	-	0	-	-	+	+	+	-	-	-	-	-	-	-	-	+	+	-
MD	+	-	+	+	+	0	0	+	+	+	0	0	+	+	+	0	-	0	0	0	+	0	+	-	0	0	+	+	+	+	+	+	+	+	0	+	+	0	0	+	+	+	-
MA	-	-	-	0	-	-	+	+	+	+	+	+	0	-	NA	0	-	NA	-	-	+	NA	-	NA	0	-	+	0	+	+	+	+	0	0	NA	-	NA	0	+	+	0	-	-
MI	-	0	+	+	-	-	0	0	+	+	+	+	-	+	+	+	0	-	0	+	-	+	-	NA	+	-	-	+	-	-	+	+	0	-	-	-	-	-	-	-	0	NA	0
MN	-	-	-	+	-	-	0	+	+	+	+	+	+	+	-	-	-	-	-	-	0	-	-	-	0	-	0	-	+	+	+	+	-	-	-	-	-	0	0	+	+	+	-
MS	-	-	-	-	-	-	-	-	-	-	-	+	NA		+	+	+	-	-	+	+	-	-	NA	-	-	+	+	-	-	+	+	-	-	-	-	-	-	+	-	-	NA	+
MO	-	-	-	+	-	0	0	-	+	+	-	-	-	+	-	-	-	-	-	-	0	+	-	NA	-	-	-	-	-	+	+	+	+	-	NA	-	-	+	+	+	+	+	0
MT	-	+	-	+	-	-	NA	NA	-	+	+	+	+	+	-	-	-	-	-	-	-	-	+	NA	-	-	-	-	+	0	+	+	-	+	+	+	+	0	+	-	+	+	-
NE	-	-	-	-	-	-	+	-	-	-	-	+	+	+	-	+	-	-	-	-	+	+	-	-	+	-	+	+	+	+	+	+	-	-	-	-	-	-	+	+	-	-	-
NV	-	-	-	-	-	NA	-	-	-	-	+	+	+	+	-	+	+	-	-	+	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
NH	-	-	-	0	-	0	+	+	+	+	-	+	+	-	NA	-	-	-	-	-	-	-	-	NA	-	-	+	0	NA	NA	+	+	-	-	-	-	-	-	-	-	-	NA	-
NJ	-	+	0	+	0	0	-	-	+	+	+	0	+	-	NA	0	0	-	-	0	+	0	+	-	0	0	+	+	+	+	+	+	0	+	-	0	0	0	-	-	+	+	0
NM	-	-	+	-	-	+	+	-	+	+	NA	+	0	-	NA	-	-	-	+	-	-	-	-	NA	0	-	-	-	-	+	+	+	+	+	+	+	-	+	-	0	0	+	-
NY	-	-	-	+	0	-	+	+	+	+	+	+	+	+	-	0	-	-	0	-	+	-	-	NA	+	-	-	-	0	+	+	+	0	+	0	+	-	+	+	0	+	+	NA
NC	-	-	+	-	-	+	-	-	-	-	-	-	-	+	-	+	+	+	-	+	+	+	-	NA	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	-	-
ND	-	-	-	-	-	-	-	+	-	+	+	+	+	+	+	-	-	-	-	-	+	-	+	-	-	-	+	+	-	+	+	+	-	+	-	-	-	+	+	-	+	-	NA
OH	0	0	-	+	-	-	+	-	-	NA	-	+	+	+	+	-	-	-	-	+	+	-	+	-	+	-	-	+	+	+	+	+	+	+	0	+	+	+	+	+	+	+	-
OK	-	-	+	+	0	-	0	0	+	0	0	-	+	-	NA	0	0	-	-	-	+	0	-	NA	+	NA	+	0	+	+	+	+	+	+	-	+	-	+	0	+	0	-	0
OR	-	0	+	+	-	+	+	+	+	+	+	NA	-	+	NA	-	-	-	-	-	+	-	-	NA	+	+	+	+	+	+	+	+	+	+	+	+	+	+	0	+	+	-	NA
PA	-	-	NA	+	-	+	+	-	+	+	-	+	+	+	0	+	-	-	-	-	+	+	+	-	+	-	+	+	+	+	+	+	-	+	-	-	-	-	-	+	+	+	NA
PR	-	+	-	+	-	-	-	-	-	-	-	-	-	-	NA	-	+	-	-	+	-	-	-	NA	+	-	-	0	0	+	+	+	+	-	-	-	-	-	-	+	-	-	+
RI	+	0	0	-	-	-	+	-	+	+	-	+	+	-	NA	-	+	-	-	-	-	-	-	NA	+	-	-	-	+	+	+	+	-	+	0	+	+	-	+	0	+	-	-
SC	-	+	+	+	0	0	0	+	+	+	NA	+	+	+	-	0	+	-	0	0	0	0	NA	NA	0	+	-	+	+	+	+	+	+	+	+	+	+	0	+	0	+	+	NA
SD	-	-	-	+	-	-	+	-	-	+	-	-	+	-	NA	0	-	-	-	-	-	-	-	NA	-	-	-	0	-	+	+	+	-	-	-	-	-	-	0	-	0	NA	NA
TN	+	+	-	+	-	0	NA	-	+	0	NA	+	+	+	+	-	+	+	0	+	+	-	-	NA	+	+	+	+	+	+	+	+	+	+	+	0	+	0	+	+	+	+	-
TX	-	-	-	+	0	-	+	+	+	+	-	+	0	-	NA	-	-	-	-	-	+	+	0	+	+	0	+	+	+	+	+	+	+	+	-	+	-	+	0	+	+	-	-
UT	-	0	-	+	-	0	0	0	+	+	-	+	+	-	NA	-	-	-	-	-	+	-	+	0	+	-	+	+	-	+	+	+	-	-	-	-	-	+	-	-	+	-	NA
VT	-	0	-	+	0	0	0	0	0	+	0	0	+	+	+	+	0	0	+	+	+	+	-	NA	0	-	+	+	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0
VA	+	+	0	+	+	-	+	-	0	0	0	+	+	+	-	0	0	0	0	+	+	0	-	-	-	-	0	+	0	+	+	+	-	-	-	-	-	-	-	-	0	0	0
VI	-	+	-	+	0	+	+	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	NA	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	NA
WA	+	+	-	0	-	-	+	+	+	+	+	0	+	+	-	0	-	-	-	0	+	+	0	NA	+	-	-	+	+	+	+	+	+	+	+	0	+	+	+	+	+	+	-
WV	-	-	-	-	-	0	-	NA	0	+	0	-	+	-	NA	+	-	-	-	-	+	0	-	NA	0	-	+	0	-	+	+	+	-	0	-	-	-	0	0	-	+	0	NA
WI	0	-	-	-	-	-	-	-	-	0	0	+	+	-	-	NA	-	-	-	-	+	-	+	-	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	+	-
WY	-	-	-	+	0	0	0	+	+	+	+	0	+	+	-	-	-	-	+	-	-	-	+	-	-	-	+	+	+	+	+	+	-	-	-	-	-	+	+	-	+	0	NA

Key + = "yes", − = "no", 0 = "yes/no", NA = no answer

*In this case, a "no" answer is considered the correct answer, so it was scored as a "yes" and vice versa with respect to "yes" answers

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